R8490-8X/6

POST-WAR ENERGY ECONOMICS:

THE URBAN AND REGIONAL IMPLICATIONS

Diane De Vaul, Senior Policy Analyst
Project Director

Tom Montvel-Cohen, Policy Analyst
Jon Clark, Policy Analyst
J. R. Prestidge, Policy Analyst

Northeast-Midwest Institute
November 1982

Northeast-Midwest Institute

Tom Cochran, Executive Director

The Northeast-Midwest Institute was founded in March 1977 to serve as an independent source of reliable information concerning the economy of the 18-state region that has long formed the nation's industrial heartland. A nonprofit, tax-exempt organization, the Institute also provides non-partisan research and analysis concerning the regional implications of a broad range of federal policy initiatives. The Northeast-Midwest Congressional Coalition, the Northeast-Midwest Senate Coalition, federal agencies, governors, and state and local officials are key clients of the Institute's work, but the conclusions and opinions expressed in its publications are those of the Institute alone.

The states in the region served by the Northeast-Midwest Institute are Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and Wisconsin.

The research forming the basis for this report was conducted under a contract with the U.S. Department of Housing and Urban Development. The substance of such research is dedicated to the public. The Institute is solely responsible for the accuracy of statements or interpretations contained herein.

This paper was greatly improved by the comments and contributions of numerous individuals at the Northeast-Midwest Institute and Northeast-Midwest Congressional Coalition. In addition to providing valuable suggestions on the paper as a whole, the following individuals contributed substantially on different subjects: Tom Montvel-Cohen wrote the first draft and worked on revisions to the chapter on "Investment Trends and Employment Effects of Energy Choices." Jon Clark contributed to the section on "New Directions for Federal Energy Policy," and J.R. Prestidge provided information and expertise on recent energy tax incentives. Peter Tropper's painstaking editorial and substantive comments, particularly on economic aspects of the paper, were valuable in revising the original drafts. Anita Lindsley was responsible for the laborious process of transforming drafts into a readable paper with her typical professional approach.

In addition, officials at the Energy Information Administration were extremely helpful and timely in providing requested information and technical comments.

Copies of this publication are available from:

Northeast-Midwest Institute
Publications Office
P.O. Box 37209
Washington, D.C. 20013

Single copy price $9.00
Please enclose $1.50 for postage with each order.

Copyright 1982 Northeast-Midwest Institute

CONTENTS

I. INTRODUCTION 1

II. THE REGIONAL BIAS OF FEDERAL ENERGY INCENTIVES 5

III. URBAN ENERGY NEEDS 27

IV. INVESTMENT TRENDS AND EMPLOYMENT EFFECTS OF ENERGY CHOICES 43

V. THE REAGAN ADMINISTRATION'S ENERGY POLICIES 48

VI. NEW DIRECTIONS FOR FEDERAL ENERGY POLICY 53

VII. CONCLUSION 59

NOTES 60

BIBLIOGRAPHY 68

INTRODUCTION

Since the end of World War II federal energy policies have created a bewildering array of programs and tax incentives often criticized for lacking a coherent focus on national energy needs. Yet the need for a coordinated, effective energy policy has never been greater. The impact of energy price increases on our national economy has been substantial; because of past federal energy policies, natural resource differences, and other factors, their impact on regional, state, and local economies varies widely between energy consuming and energy producing areas.

Since 1945, the federal government has recognized that the era of plentiful, cheap domestic supplies of oil and gas is at an end. In response, the government has tried to formulate policies to achieve several objectives, including:

- o ensuring adequate supplies of energy for a healthy, expanding economy;
- o keeping the price of energy as low as possible;
- o protecting the nation against supply disruptions, and
- o providing a smooth transition from reliance on limited fossil fuels (oil and gas) to relatively abundant sources (coal, nuclear, renewable, and synthetic).

Although the basic problems have remained the same, both the solutions and their relative importance have changed over time. To ensure the supply of energy needed to expand the U.S. economy after World War II and to protect domestic reserves, the federal government encouraged and supported reliance on imported fossil fuels for much of the period. Cheap and abundant oil imports kept prices declining in real terms and offered no incentive for energy efficiency. As a result, U.S. imports continued to grow. For example, in 1960 imports represented 19 percent of total oil consumption; by 1979 they represented 47 percent. (See Table 1).

In 1979, U.S. energy consumption peaked at an all-time high of 79 quadrillion BTUs (quads). The U.S. produced 64 quads and imported 5.64 million barrels of oil a day from OPEC countries. By 1981 U.S. energy consumption dropped to 74 quads, a decrease of 6.3 percent, and domestic energy production rose 1.2 quads, or up .8 percent. At the same time, imports of OPEC crude oil fell from 5.6 to 3.3 million barrels a day.

The oil supply "glut" that resulted in lower prices for imported and domestic oil during the last two quarters of 1981 and the first quarter of 1982 demonstrated the impact of lowered demand on world-wide prices and supplies. However, the price decreases were slight compared to overall increases since 1973. U.S. production, despite record levels of new drilling, has not increased dramatically, and it is not known how much of the decrease in consumption and price is attributable to reduced activity in a recessionary economy and how much reflects longer-lasting efficiency gains (see Table 2).

However, over 70 percent of the total drop in energy consumption between 1979 and 1981 occured in the industrial sector, suggesting that the recession, as well as investments in energy efficiency is a significant factor in reduced U.S. energy use. Energy use in the industrial sector dropped 3.6 quads compared to less than half a quad in the combined residential and commercial sectors and 1.2 quads in the transportation sector.

Increased energy costs altered the U.S. balance of trade both directly, through higher prices paid for imported oil, and indirectly, by reducing the ability of the nation's industrial base to compete in the world market. Although imports dropped in 1981, the U.S. trade deficit increased by 14 percent, from $24.2 billion in 1980 to $27.5 billion.[2]

Rapid increases in energy prices also have contributed to a shift in the balance of trade between energy producing and energy consuming areas within the United States, affecting regions, states, and local economies for a number of reasons:

- o State and local economies vary widely in their employment base, degree of industrial development, and pattern of energy use. Between 1972 and 1977, for example, earnings in the coal industry increased by 236 percent and in oil and gas by 321 percent, compared to 151 percent for all other industry.[3] Higher energy costs had a powerful impact on energy-intensive such as glass and steel manufacturing industries. They have affected every aspect of the automobile industry, from design to manufacturing to marketing. Many of these industries are concentrated in the older states of the Midwest and Northeast. Moreover, the average price of available energy varies substantially for some fuels. Electricity prices in the manufacturing

TABLE 1

FOREIGN OIL CONSUMPTION IN THE UNITED STATES
(1960-79)

Year	Consumption (Millions of Barrels/Day)	Production	Imports	Imports As % of Consumption
1960	9.7	8.0	1.8	19 percent
1962	10.2	8.4	2.1	21 percent
1964	10.8	8.8	2.3	21 percent
1966	11.9	9.6	2.6	22 percent
1968	13.0	10.6	2.8	22 percent
1970	14.4	11.3	3.4	24 percent
1972	16.0	11.2	4.7	29 percent
1974	16.2	10.5	6.1	38 percent
1976	17.0	9.7	7.3	43 percent
1979 (est.)	19.0	10.0	9.0	47 percent

SOURCE: Robert Stoubaugh and Daniel Yergin, editors, Energy Future: Report of the Energy Project at the Harvard Business School (New York, New York: Random House, 1979), p. 18.

sector varied between states by over 700 percent in 1980.[4] This is especially significant for relative regional economic performance, since 87 percent of manufacturing establishments use electricity in their manufacturing processes and electricity accounts for 32 percent of industrial fuel use.[5]

- Higher energy prices that cut into real disposable income affect the purchase of local goods and services. Expenditures on energy produce only half the employment of expenditures on goods and services. This effect has been notably severe in the Northeast and Midwest, where average state energy prices are higher, the climate is cold, and older buildings are less energy efficient. The average price of residential energy varied between states by an estimated 189 percent in 1980.[6]

- Higher prices also affect the commercial sector adversely. Average state commercial energy prices varied by roughly 120 percent in 1980, with the highest average prices in the Northeast and the lowest in the Northwest.[7] Higher prices have increased operating expenses for commercial establishments, schools, hospitals, and government buildings.

TABLE 2

PETROLEUM PRICE SUMMARY
(dollars per barrel)

Year/ Month	Actual Domestic Wellhead Price	Refiner Acquisition Price of Crude	
		Domestic	Imported
1976	$8.19	$8.84	$13.48
1978	$9.00	$10.61	$14.57
1980	$21.19	$24.23	$33.89
1981	$31.77	$34.88	$37.14
Jan.	$28.85	$32.71	$38.85
Feb.	$34.14	$36.27	$39.00
Mar.	$34.70	$36.97	$38.31
Apr.	$34.05	$35.58	$38.41
May	$32.71	$35.21	$37.84
June	$31.71	$34.20	$37.03
July	$31.13	$33.76	$36.58
Aug.	$31.13	$33.79	$35.82
Sep.	$31.13	$33.47	$35.44
Oct.	$31.00	$33.48	$35.43
Nov.	$30.98	$33.49	$36.26
Dec.	$30.72	$33.47	$35.80

SOURCE: Energy Information Administration, Monthly Energy Review (Washington, D.C.: Department of Energy, March 1982).

These energy price increases and the national security implications of U.S. dependence on imported oil have shifted energy policy debate to the following problems:

- o how to maintain a healthy economy in a period of relatively expensive energy, and
- o how to rebuild a more energy-efficient industrial base that can compete in the world market.

This paper presents an overview of the urban and regional implications of past federal energy policies and the public revenues and tax incentives used to implement them. The regional impact of these policies has varied significantly, as have the rural and urban impacts. Although it has not always been possible to quantify these geographic variables in absolute terms the report documents significant trends in investment and employment. The report also analyzes current national energy policy within the context of past policies. The final section outlines some policy alternatives designed to make federal energy policy more geographically equitable and economically effective.

A major finding of this paper is that the federal government failed in the past to consider adequately the impact of federal energy policies on regions and urban areas. There are many reasons for this: relatively low energy prices masked the effect of these policies prior to 1973, and a lack of adequate information and analytic capability within the government hindered identification of the geographic impacts. This paper identifies several least-cost strategies to correct this problem while pursuing the goals of increased reliance on state and local decision-making and market forces to determine the nation's energy future.

II. THE REGIONAL BIAS OF FEDERAL ENERGY INCENTIVES

Throughout much of the period since World War II federal energy policy was neither comprehensive nor coherent. Hindered by a lack of information, by the assumption that a growing gross national product depended on ever-growing energy consumption, and by its access to relatively cheap supplies of imported oil, the nation was ill-prepared to deal with the rapid price increases brought about by the OPEC embargo of 1973-74 and the Iranian Revolution of 1979. Since then, energy experts have documented the fact that the United States is one of the most energy inefficient of western industrialized nations.

The U.S. has finally begun to recognize both the national security implications of growing dependence on imported petroleum and the long-range need to switch from oil and gas to more abundant coal and a set of less traditional sources of energy. Although concern about the level of oil imports has been expressed repeatedly at the highest levels of public policymaking, U.S. dependence increased over the period 1945-1980. As imports grew, most Federal energy incentives were designed to protect and stabilize U.S. oil production capability. This was especially true during periods of declining prices attributed to cheap foreign oil. The U.S. also made a substantial investment in the development of large-scale hydroelectric facilities, particularly in the South and West; in the provision of relatively inexpensive electricity to rural areas, and in the development of relatively expensive synthetic fuels and nuclear power. This pattern of federal spending has affected both regional and urban development significantly.

The extent of federal involvement in the energy area is reflected in the data on federal spending and tax incentives.[9] The most extensive examination of federal investment in energy production was undertaken in a 1980 study by the Battelle Memorial Institute. As shown in Table 3, federal incentives have been substantial, totaling $217.42 billion from 1950 to 1977 (calculated in constant 1977 dollars).

Oil Production Incentives

The Battelle study found that the oil industry received 46.6 percent of all federal energy incentives ($101.3 billion) in the period 1950-1977. Most of these incentives were in the form of preferential tax provisions. However, regulatory incentives -- primarily special price provisions -- also provided substantial assistance to this sector. Preferential taxation consisted primarily of permitting firms to "expense" intangible drilling costs (initiated in 1917) and granting a percentage depletion allowance (beginning in 1926).[10] The depletion allowance was 27.5 percent (compared to 5 percent for coal) until 1970, when it was reduced to 22 percent. Altogether, preferential taxation subsidies amounted to $50.4 billion between 1950 and 1977. The second largest category of incentives included stripper well[11] and production price provisions for newly discovered oil.[12] From 1974 (when these provisions were established) to 1977, stripper well pricing totaled $12 billion, and new oil provisions came to approximately $24 billion. The remaining inducements included allowing a high rate of return on pipeline investments, charge-free maintenance of ports and waterways, oil tanker subsidies, and government-sponsored R&D programs.[13]

World War II made the importance of abundant oil supplies crystal clear to the United States. In 1945, the State Department claimed that the U.S. won the war in large part because it had abundant supplies of petroleum, and that Germany and Japan lost in part because they fought for such supplies but didn't succeed in capturing them in time. After the war, it was clear that worldwide demand for oil would rise and U.S. production would decline. It was essential, the State Department argued, that the government give "active, energetic, and consistent support . . . to the United States petroleum industry in its foreign operations and problems."[14]

By 1948, the level of oil imports had increased substantially, and for the first time since the early 1920s imports exceeded exports. By 1950, the coal industry and others were putting increased pressure on the government to deal with expanded oil imports, which were cutting into the market for domestic energy supplies. Imports had increased from 188 million barrels a day in 1948 to 310 million in 1950. In response to domestic producers' concerns President

TABLE 3

CUMULATIVE COST OF INCENTIVES USED TO STIMULATE ENERGY PRODUCTION
1950 to 1977
(in billions of dollars)

	Nuclear	Hydro*	Coal	Oil	Gas	Elec.*	Total	Percent of Total Incentives
Taxation		1.8	4.03	50.4	16.04	31.37	103.64	47.7
Disbursements				1.1			1.10	0.5
Requirements	1.1	0.03	0.67	41.9	0.06		43.76	20.1
Traditional Services			2.31	6.0		0.48	8.79	4.0
Nontraditional Services	15.1		2.68	1.5	0.3		19.58	9.0
Market Activity	1.8	13.5	0.02	0.4	0.1	24.73	40.55	18.7
Totals	18.0	15.33	9.71	101.3	16.50	56.58	217.42	100.0
Percent of Total Incentives	8.3	7.0	4.5	46.6	7.6	26.0	100.0	

*Incentives for hydro and electricity include 1933-1977.

SOURCE: Battelle Memorial Institute, An Analysis of the Results of Federal Incentives Used to Stimulate Energy Production (Richland, Washington, June 1980), p. 1.5.

Eisenhower first attempted to impose voluntary import controls. When this proved ineffective, in 1959 he established mandatory controls that permitted imports to grow only to meet the net increase in demand.[15]

Although President Kennedy was sympathetic to the complaints by the coal industry that favorable treatment of the oil industry and rising imports were reducing the demand for coal, a comprehensive study of petroleum requirements and supplies and their relation to national security objectives ordered by him argued that any radical departure from the status quo would have serious repercussions. "Petroleum is basic to the economies of the principal producing States," the Petroleum Study Committee reported, "affecting levels of employment, business activity, and the revenues of State governments. . . A sharp decline in the level of prices or of production would create pockets of economic distress and unemployment."[16]

Relying on these and other studies, the Kennedy and Johnson administrations continued the basic structure of the oil import control system with only slight modifications.

President Nixon's Economic Stabilization Program established price controls on energy products by monitoring profits on a firm-by-firm basis. Although the program allowed for increases, the prices of gasoline, no. 2 fuel oil, and residual fuel oil were frozen. The Emergency Petroleum Allocation Act of 1973 required the government to institute allocation plans for crude oil and all petroleum products, continue price controls, and provide a plan for energy self-sufficiency by 1980. Both the Emergency Petroleum Allocation Act of 1973 and the Federal Energy Administration Act of 1974 required continued allocation and price control unless the president found that no domestic shortage existed, continued regulation would be unnecessary to fulfill the purposes of the acts, and no adverse effect was expected on the supply of any other product. Under authority provided in the Energy Policy and Conservation Act of 1975, President Carter moved to decontrol the price of domestic oil. The Act specified that by October 1, 1981, all controls would end and domestic oil would sell at the international price. President Reagan completed decontrol in January 1981 by issuing an executive order to that effect.

The Crude Oil Windfall Profits Tax Act of 1980 imposed an excise tax on the profits resulting from the decontrol of oil prices. Sponsors of the legislation felt that the oil companies should not reap the benefits of decontrol at the expense of consumers, who had no control over the world price of oil. As originally conceived, the tax was to provide funds to encourage conservation and unconventional energy production and energy assistance to low income households to help with higher fuel bills. The windfall profits tax, however, exempts state-owned oil from taxation, and allows oil producers to deduct state severance taxes and windfall profits taxes as business expenses when figuring their income tax. As a result, the net revenue received is substantially lower than the total collected. According to the Washington Post, in 1981 the federal government collected $23.3 billion under the windfall profits tax, but the deduction of the tax as a business expense reduced the revenue to only $9.5 billion. In addition, the Economic Recovery Tax Act of 1981 further reduced the revenues raised for the windfall profits tax by:

- reducing the tax on newly discovered oil produced after the decontrol order;

- providing an exemption to all independent production from stripper wells, and

- providing tax credits for royalty owners amounting to two barrels per day in 1982-83 and three barrels per day in 1985-86.[17]

Regional Implications. Since World War II the federal government has argued that for national security reasons, tax incentives and other subsidies to the domestic oil industry are necessary to maintain domestic capacity in case of supply disruptions. Policymakers also have argued that such incentives are necessary to the economic health of producing states; they base this claim on the view that a withdrawal of incentives would produce unemployment and economic distress in these areas. The Battelle study reported that although it was impossible to determine the effectiveness of such incentives in expanding domestic production, they amounted to significant benefits for oil producing areas. Federal incentives for domestic oil production contributed to a healthy domestic oil industry during the period studied. For example, although oil production is much more capital intensive than manufacturing in general (requiring an investment of $108,000 per employee compared to $19,500 for average manufacturing jobs), between 1972 and 1977 employment in the oil and gas industry increased by 141 percent, compared to 110 percent in all other industry.[18] Similarly, earnings in the oil and gas industry in the same period increased by 221 percent, compared to a 51 percent increase for all other industry.[19]

This trend, coupled with the local indirect employment effects of consumer spending on local economies (see Chapter IV), resulted in significant economic benefits for domestic oil producing areas.

Although a precise state-level breakdown of federal incentives is not available, Table 4 gives the percentage of domestic energy production by state in 1978 for major fuel sources. Ninety-eight percent of oil was produced in the South and West in that year. Oil production was concentrated in Louisiana (16.8 percent), Oklahoma (4.7 percent), Texas (33.8 percent), Alaska (14.1 percent), California (10.9 percent), Wyoming (4.3 percent), and New Mexico (2.6 percent). In addition, by keeping the price of petroleum products low and by expanding imports to meet increased demand, federal policies encouraged oil consumption and left consuming states unprepared to deal with abrupt increase in prices.

Gas Production Incentives

Federal incentives for natural gas production had a total dollar value of $16.5 billion from 1950 to 1977, representing 7.6 percent of total federal energy incentives. Intangible drilling costs and percentage depletion allowances accounted for 97 percent of this amount.[20]

Regional Implications. Like tax incentives for oil production, natural gas incentives have benefited producing states. The Battelle study noted that well-head price controls on natural gas produced for interstate commerce created shortages that affected industrial users the most. Between 1972 and 1975, for example, the total number of industrial natural gas users fell by 17.2 percent. As a result, some firms in the chemical industry that rely heavily on natural gas as a raw material located new plants in producing states to avoid supply interruptions.[21]

TABLE 4

ENERGY PRODUCTION BY STATE AND REGION
AS A PERCENT OF TOTAL U.S. PRODUCTION, 1978

	Coal	Gas	Oil	Uranium
NEW ENGLAND				
Total	0	0	0	0
MID-ATLANTIC				
Maryland	.5			
New York		.1		
Pennsylvania	12.2	.6	.1	
Total	12.7	.7	.1	0
MIDWEST				
Illinois	7.3		.7	
Indiana	3.6		.1	
Michigan		.7	1.1	
Ohio	6.2	.6	.4	
Total	17.2	1.3	2.3	0
SOUTH				
Alabama	3.1	.4	.6	
Arkansas	.1	.5	.6	
Florida		.3	1.5	*
Kentucky	20.4	.4	.2	
Louisiana		37.4	16.8	
Mississippi		.5	1.3	
Oklahoma	.9	8.9	4.7	
Tennessee	1.5			
Texas	3.0	32.8	33.8	*
Virginia	4.8			
West Virginia	12.8	.7	.1	
Total	46.6	82.0	59.6	
WEST				
Alaska	.1	1.0	14.1	
Arizona	1.4			*
California		1.6	10.9	
Colorado	2.1	.9	1.2	*
Kansas	.2	4.3	1.8	
Missouri	8.5			
Montana	4.0	.2	1.0	
New Mexico	1.9	5.6	2.6	47.0
North Dakota	2.1	.2	.8	
Utah	1.4	.3	1.0	*
Washington	.7			*
Wyoming	8.8	1.8	4.3	27.0
Total	23.4	16.1	37.9	

* These states account for 26 percent of the uranium production; no state level data is available.

SOURCE: Calculations based on data in Congressional Research Service, Library of Congress, The Energy Factbook: Data on Energy Resources, Reserves, Production, Consumption, Prices, Processing, and Industry Structure (prepared for the Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, November 1980), pp. 10, 705.

Natural gas production is located primarily in the South. In 1978, for example, 82 percent of domestic production occurred in the South, with Louisiana (37.4 percent), Oklahoma (8.9 percent), and Texas (32.8 percent) accounting for the bulk of it. In the West, Kansas with 4.3 percent and New Mexico with 5.6 percent accounted for the most of the regional share of 16.1 percent.

Coal Production Incentives

The government provided $9.7 billion in federal production incentives to the coal industry between 1950 and 1977. This represents 4.5 percent of total incentives, the smallest provided any energy source reviewed by the Battelle report. Most of the incentives, $4.0 billion, were in the form of preferential tax provisions, primarily the percentage depletion allowance. "Nontraditional services" represented the next largest category of incentives for coal, totaling $2.5 billion. Programs in this category included mining methods and systems, mechanization, coal cleaning processes, mine health and safety, synthetic fuel development, and pollution control. These expenditures have increased substantially since the OPEC oil embargo. Coal incentives remained relatively stable from 1950 to 1969, increased slightly over the next few years, and then increased dramatically during 1974. For example, from 1955 to 1969 annual federal incentives ranged from $200 to 260 million. From 1970 to 1974 they increased from $300 to 600 million. By 1976 they reached $1 billion annually.[22]

In 1944 Congress passed the Synthetic Liquid Fuels Act, which authorized up to $85 million for synthetic fuels programs, but this early program ran into a number of problems: opposition from the national oil industry, inability of synthetic fuels to compete with cheap imported oil, water resource requirements, and disagreement over the real costs of synthetic fuel production. Although money was allocated for synthetic fuel research, the Truman administration decided against federal incentives for commercial development of synthetic liquid fuels. The Kennedy administration focused on stimulating coal exports and continuing research on new coal uses. During the Johnson administration, coal spokesmen complained bitterly about federal commitment to nuclear power development as compared to the relatively minor support for synthetic fuel development, but didn't succeed in making any significant progress.

President Carter gave coal a key role in his National Energy Plan. He called for an 80 percent increase in coal production -- from about 680 tons in 1976 to over 1.2 billion tons in 1985.[23] The Energy Supply and Environmental Coordination Act of 1974 authorized the Federal Energy Administration to order power plants and other major fuel burring installations to substitute coal for oil or gas as their boiler fuel. Because of environmental problems, this initiative proved not very effective.[24]

Congress established the Synthetic Fuels Corporation as part of the Energy Security Act of 1980 as an independent, off-budget federal entity with an authorization of up to $88 billion for the development of synthetic fuels from coal, oil shale, and tar sands. In 1980 Congress appropriated $17.5 billion for development through 1984.

Regional Implications. Although coal is the most abundant source of fossil fuels in the U.S., it represents a much smaller percentage of total U.S. energy consumption today than in the past. In 1946, for example, coal accounted for roughly half of all U.S. energy use; in 1978, it represented only 20

percent.[25] Funding for synthetic fuel development and research and programs to develop pollution control devices were supported in part by arguments that expanded use of coal would relieve the severe economic distress in the coal industry. However, other federal policies pursued since World War II, including higher depletion allowances for oil and gas, subsidies for pipelines at a time of high rail freight rates for coal, and increased imports, particularly of relatively low-cost residual oil, encouraged a shift in consumption from coal to oil and gas.

Under the current legislation, synthetic fuel development on a large scale benefits Western and Southern coal producing states primarly. Of the initial 11 projects considered for federal funding in early 1982, none was in the Northeast or Midwest; one was located in Alabama, two in California, two in Kentucky, one in North Carolina, two in Tennessee, one in Utah, and two in Wyoming.

Nuclear Power

The federal government provided $18.0 billion in incentives for commercial nuclear power between 1948 and 1977, representing 8.3 percent of total federal energy incentives. Research and development funds accounted for $15.1 billion, of which 62 percent was spent on the civilian reactor development program. More recently, most of these funds were spent on the Liquid Metal Fast Breeder Reactor program -- a total of $3.1 billion by 1977. Federal investment in uranium enrichment facilities is another incentive to commercial nuclear power, and accounts for $1.8 billion of the total. Since 1965, the federal government has provided utilities with enriched uranium on a cost recovery basis.[26] Other federal incentives to the nuclear industry were not quantified by Battelle. It is difficult to account for the benefit of the Price-Anderson Act, (which provides federal liability for nuclear accidents, and other policies such as long-term uranium procurement that were initiated for military programs but benefited the commercial nuclear power industry.[27]

During the Truman administration, energy experts expressed optimism about the potential use of atomic energy for peaceful purposes, but most of the time and money was spent on weapons development. The Eisenhower administration took some of the initial steps to encourage the generation of electricity from nuclear power. The Kennedy administration pursued the development of nuclear power more vigorously. During that period, the Atomic Energy Commission (AEC) argued successfully that nuclear power could stimulate economic growth in lagging regions of the country. The AEC claimed that "high cost power areas would no longer exist, since, in the absence of significant fuel transportation expenses, the cost of nuclear power is essentially the same everywhere. This would be an economic boon to areas of high cost fossil fuels, and by enabling them to compete better, should increase the industrial potential of the entire country."[28] During the Johnson administration, the development of a commercially successful nuclear power industry proceeded rapidly. By the beginning of the Nixon administration, 65 nuclear plants had been ordered.

President Carter expressed concern about the implications of rapid development of nuclear technology, such as international problems of nuclear proliferation, siting controversies, safety problems, and the unresolved matter of nuclear waste storage facilities. Escalating costs and public concern about nuclear power development slowed nuclear construction, so that the total amount of electricity generated from nuclear power actually dropped by 9.1 percent from 1978 (its peak year) to 1980, while overall electricity generation in-

creased slightly, by 3.6 percent. The average capital cost of nuclear units ordered in 1978 was estimated to be $920/kw, compared to an average of $361/kw for fossil fuel plants.[29]

Regional Implications. Table 5 shows the location of existing and planned nuclear power plants in the United States in 1981. The regions leading in the development of these plants are the Northeast and Midwest, with 55 percent of existing plants, and the South, with 33 percent. New Mexico and Wyoming accounted for 74 percent of uranium supplies in 1978. The major fuel processing and milling plants are located in the West, as illustrated in Figure 1.

Hydroelectric Development

Total federal incentives to hydroelectric production from 1933 to 1977 came to $15.3 billion. Of this total, $13.5 billion represents federal investment in the construction and operation of federal dams.[30] Federal tax-exempt power revenues make up the final category of incentives, amounting to $1.8 billion. Through these expenditures and subsidies the federal government had a substantial impact on hydroelectric development. By 1977, 145 federally managed hydroelectric projects -- 13 percent of major hydro facilities -- accounted for 51 percent of actual power generation. Federally subsidized, cooperatively managed facilities produced an additional 24 percent of generation.[31]

The Truman administration promoted hydroelectric power as an economic development tool, linking dams to related objectives like land reclamation, irrigation, flood control, national defense, and regional development. Conventional wisdom during the Truman administration held that cheap power was exceptionally important to economic revival in the short run and economic development over the long run.[32] Policymakers claimed that cheap electricity was necessary to insure the economic viability of the small farmer and the small community. It also was argued that unlike other nonrenewable energy sources, hydro power was wasted if it was not developed. Western and plains states maintained that the unavailability of electricity at reasonable rates constrained their growth. By the end of World War II, the federal government had the responsibility for disposing of electricity from major public hydro projects; in addition, the Flood Control Act of 1944 provided for a large program of new multipurpose projects, including power production.

The Eisenhower administration continued and completed projects proposed by earlier administrations, particularly in the Northwest. The Kennedy administration reaffirmed this federal responsibility, especially for multiple-purpose river projects, and subsequent administrations continued support for regional power administrations and development of hydro power.

Regional Implications. The federal government supported hydroelectric development in part to stimulate economic development of the West and South. Federal investment in the Bonneville Power Administration totaled $6.2 billion; in the Tennessee Valley Authority $1.9 billion; in the Southeastern Power Administration $1.7 billion; in the Southwestern Power Administration $1.2 billion; in the Alaska Power Administration $.2 billion, and in projects of the Bureau of Reclamation (in the Western U.S.) $2.4 billion.[33]

Table 5

NUCLEAR POWER PLANTS IN THE U.S., 1981

	Operable	Under Construction	Limited Work Authorization	On Order
NEW ENGLAND				
Maine	1			
New Hampshire		2		
Vermont	1			
Massachusetts	2			
Connecticut	3	1		
Rhode Island				
Total	7 (9%)	3 (4.1%)	0	0
MID-ATLANTIC				
Delaware				
Maryland	2			
New Jersey	3	1		
New York	5	2		
Pennsylvania	6	5		
Total	16 (20.5%)	8 (10.8%)	0	0
MIDWEST				
Illinois	7	8		2
Indiana		2		
Iowa	1			1
Michigan	4	3		
Minnesota	3			
Ohio	1	3		
Wisconsin	4			
Total	20 (25.6)	16 (21.6%)	0	3
SOUTH				
Alabama	5	2		
Arkansas	2			
District of Columbia				
Florida	4	1		
Georgia	2	2		
Kentucky				
Louisiana		3		
Mississippi		4		
North Carolina	3	3		3
Oklahoma			2	
South Carolina	4	6		
Tennessee	2	8		1
Texas		4		1
Virginia	4	1		
West Virginia				
Total	26 (33.3%)	34 (45.9%)	2	5
WEST				
Alaska				
Arizona		3		
California	4	3		
Colorado	1			
Hawaii				
Idaho				
Kansas		1		
Missouri		1		
Montana				
Nebraska	2			
Nevada				
New Mexico				
North Dakota				
Oregon	1			2
South Dakota				
Utah				
Washington	1	5	0	2
Wyoming				
Total	9 (11.5%)	13 (17.6%)		
U.S. TOTAL	78	74	2	12

SOURCE: Atomic Industrial Forum, "Nuclear Power Plants in the U.S." (Washington, D.C., December 31, 1981), p. 9.

FIGURE 1.

URANIUM MILLS IN THE UNITED STATES OPERATING AS OF 1/1/79

Source: Department of Energy

SOURCE: Calculations based on data in Congressional Research Service, Library of Congress, The Energy Factbook: Data on Energy Resources, Reserves, Production, Consumption, Prices, Processing, and Industry Structure (prepared for the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce, U.S. House or Representatives, November 1980), p. 642.

BEST AVAILABLE COPY

Partly as a result of the geographic bias of this pattern, prices for electricity vary more between states than for any other energy source. In 1980, the average state cost of electricity varied by the following percentages:

- o residential, 345 percent (New Jersey high; Washington State low);
- o commercial, 329 percent (New York; high; Washington low);
- o industrial, 725 percent (Rhode Island high; Washington low).[34]

Generally, rates are substantially lower in Federal Power Marketing Administration areas than in areas served by private utilities; in 1977 the average electricity price for industry was five times as much as the average price of electricity marketed by Power Marketing Administrations.[35] Federal Power Marketing Administrations also provide an important institutional base for regional planning and access to capital whose effective cost in 1977 was half that available to investor-owned utilities.[36] Figure 2 shows the boundaries of the power administrations. Table 6 shows the percent distribution of hydroelectric generation by state in 1979.

Other Electricity Generation and Transmission*

Utilities began selling electricity in 1897. By 1900, of a total of 3,620 utility systems, 2,805 were investor-owned. The federal role in the generation and transmission of electricity was established prior to World War II in the following major legislative initiatives:

- o The federal government became involved in the generation of electricity in 1906 with the Reclamation Act.
- o The Boulder Canyon Act of 1928 provided for the federal role in the marketing of electricity. During the Depression, the federal government established the Tennessee Valley Authority (TVA) as an experiment in economic development of a region through the generation of electricity.
- o The Rural Electrification Act of 1936 established a strong federal role in producing and distributing electricity to rural areas. The high cost of transmission and distribution of electricity in rural areas had kept the availability of electricity to only 10 percent of the farms in the early 1930s compared to an average of roughly two-thirds of the population nationally.[37]

Three general types of incentives are available for electricity: taxation, which includes all tax breaks and exemptions to the utility industry; "traditional services," which includes the cost of regulating the industry, and market activity, which includes savings derived from federal capital sharing programs.

These tax incentives to the industry totaled $34.8 billion from 1933 to 1977, accounting for 58 percent of all federal incentives for electricity. In recent years, tax incentives have increased to roughly 80 percent of all federal incentives for electricity. The exemption of government and cooperatively owned utilities from federal income tax payments accounted for all tax incentives prior to 1954 and 40 percent from 1954 to 1977. The doubling of incentives in 1955 was the result of liberalized depreciation for privately-owned electric generation facilities, which accounted for $13 billion or 37 percent of tax incentives from 1955 to

FIGURE 2

FEDERAL POWER MARKETING AUTHORITIES

Bonneville Power Administration
P.O. Box 3621, Portland, OR 97208
Western Area Power Administration
P.O. Box 3402, Golden, CO 80401
Southeastern Power Administration
Elberton, GA 30635
Southwestern Power Administration
P.O. Drawer 1619, Tulsa, OK 74101

SOURCE: Solar Energy Research Institute, A New Prosperity: Building A Sustainable Energy Future (Andover, Massachusetts: Brick House Publishing Company, 1981).

BEST AVAILABLE COPY

Table 6

HYDROELECTRIC GENERATION BY STATE, 1979

	Percent National Total
NEW ENGLAND	
Connecticut	.2
Maine	.6
Massachusetts	.1
New Hampshire	.4
Rhode Island	*
Vermont	.3
Total	1.6
MID-ATLANTIC	
Delaware	0
Maryland	.8
New Jersey	0
New York	9.4
Pennsylvania	.4
Total	10.5
MIDWEST	
Illinois	*
Indiana	.2
Iowa	.3
Michigan	.4
Minnesota	.3
Ohio	*
Wisconsin	.7
Total	1.9
SOUTH	
Alabama	4.2
Arkansas	1.2
D.C.	0
Florida	.1
Georgia	1.6
Kentucky	1.4
Louisiana	0
Mississippi	0
North Carolina	2.8
Oklahoma	.8
South Carolina	1.4
Tennessee	4.4
Texas	.4
Virginia	.5
West Virginia	.2
Total	19.0
WEST	
Alaska	.2
Arizona	2.6
California	12.1
Colorado	.6
Hawaii	*
Idaho	3.3
Kansas	*
Missouri	.4
Montana	3.7
Nebraska	.4
Nevada	.6
New Mexico	*
North Dakota	1.0
Oregon	10.7
South Dakota	2.3
Utah	.3
Washington	28.4
Wyoming	.4
Total	67.0

	Percent National Total
NORTHEAST	12.1
MIDWEST	1.9
NORTHEAST AND MIDWEST	14.0
SOUTH	19.0
WEST	67.0
SOUTH AND WEST	86.0

*Less than .1 percent.

SOURCE: Calculations based on data in Congressional Research Service, Library of Congress, The Energy Factbook: Data on Energy Resources, Reserves, Production, Consumption, Prices, Processing, and Industry Structure (prepared for the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce, U.S. House of Representatives, November 1980), p. 642.

1976. In 1964, government-sponsored utilities were permitted to float tax-free bonds, which allowed them to sell bonds at a lower rate than taxable investor-owned utilities. This resulted in a loss to the Treasury of $3.11 billion, or about 9 percent of the total incentives for electricity generation and transmission. The investment tax credits extended to investor-owned utilities intermittently since 1962 amounted to $4.74 billion, or 14 percent of the total.[38]

The total federal expense for construction, operation, and maintenance of transmission systems and loans and loan guarantees for generation, transmission, and distribution systems came to $24.6 billion between 1933 and 1977. Overall, federal market activity or net federal capital outlay provided 41 percent of the incentives to utilities.[39]

Investor-owned utilities received 30.5 percent of the federal incentives for electricity through investment tax credits and liberalized depreciation through 1977. Rural Electric Administration cooperatives accounted for 38.2 percent of the total, while federal power authorities accounted for 2.4 percent; state power authorities and municipal utilities accounted for 13.0 percent; tax-free bonds for public utilities accounted for 5.4, and electricity transmission for public utilities accounted for 9.7.

Regional Implications. Most of the federal incentives for electricity have gone to municipal, federal, cooperative, and other power districts and state projects. Table 7 shows a regional breakdown of the total megawatt hours generated by type of ownership in 1979. The table indicates that the states in the Northeast and Midwest had 44.5 percent of the privately-owned utility generation, compared to the South and West with 55.5 percent. However, 85.9 percent of municipal, 99.9 percent of federal, 86.4 percent of cooperative, and 70.9 percent of power district and state utility generation were in the South and West.

In the Northeast-Midwest region, private investor-owned utilities accounted for 94 percent of total electricity generation, in the region, compared to only 69 percent in the South and West. Federal projects alone accounted for roughly 17 percent of power generation in the South and West. The bulk of federal funds for municipal, federal, cooperation, and other electricity generation and distribution supported 30 percent of power generation and transmission in the South and West compared to only 4 percent in the Northeast and Midwest.[40]

Solar and Renewable Resources

Renewable energy sources -- those not depleted through use -- include solar energy, wind power, biomass, geothermal, hydro, and other sources. Although there were some federal R&D programs for these technologies in the Ford administration, funding increased substantially under President Carter, from $70 million in 1975 to $287 million in 1977. The Carter administration believed that long-term economic expansion beyond 2000 depended on the development of renewable resources.[41]

The Department of Energy was asked in 1979 to prepare for Congress a realistic assessment of energy efficiency and renewable energy resource potential by the year 2000. The Solar Energy Research Institute (SERI) published this study in 1981 the following table shows, the potential contribution from renewable resources from existing technologies -- 12.3-22.5 quads -- is substantial.

Regional Impact. Federal incentives for solar and renewable resources are more regionally equitable than incentives for other supply sources, since each region has its own potential for renewable resources. For example, a recent Federal Energy Regulatory Commission report concluded that more than 2,000 of the nation's 3,000 old and abandoned small hydro projects could be returned to service, adding 1,300 MW of capacity. Most are located in New England and Great Lakes states.[42] Biomass and wind systems could provide energy through much of the United States and are particularly suited to rural areas. Passive solar designs for buildings have enormous potential for cutting energy use regardless of their location. Active solar systems for electricity generation probably would be concentrated more in the Southwest.

Table 9 below gives a state-by-state breakdown of residential energy credits claimed in 1980 for both conservation and renewable energy investments. States in the Northeast-Midwest region accounted for 63 percent of the "conservation" investment and 31.7 percent of the "renewable" investments.

Energy Efficiency/Conservation

Energy efficiency means doing the same job (whether driving a car, manufacturing steel, or heating a building) with less energy. Most of the buildings, industries, and transportation modes in the U.S. were built in an era of cheap energy and were not designed for energy efficiency. For example:

- Ninety percent of existing housing was built before 1975;[43]

TABLE 7

PERCENT DISTRIBUTION OF UTILITIES BY OWNERSHIP, 1979

	Private	Municipal	Federal	Cooperative	Other**	Total
Northeast						
New England	4.4	.8	*	*	*	3.5
Mid-Atlantic	15.2	1.2	*	0	28.6	13.4
Northeast Total	19.6	2.0	*	*	28.6	16.9
Midwest	24.9	12.2	.1	13.6	.4	20.3
South	38.0	38.3	55.8	33.9	11.0	38.4
West	17.5	47.6	44.1	52.5	59.9	24.4
Northeast and Midwest	44.5	14.2	.1	13.6	29.0	37.2
South and West	55.5	85.9	99.9	86.4	70.9	62.8

* Less than .1 percent.
** Power districts and state projects.

SOURCE: Congressional Research Service, Library of Congress, The Energy Factbook: Data on Energy Resources, Reserves, Production, Consumption, Prices, Processing, and Industry Structure (prepared for Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, November 1980), p. 651. Calculations are based on percentages of total megawatt hours generated.

- Eighty-seven percent of commercial buildings, including state and local government buildings, schools, and hospitals, were built before 1974 ; and

- eighty-six percent of industrial plants were built before 1974.[44]

On the one hand, low prices and a lack of incentives to conserve combined to make the U.S. one of the least energy efficient of industrialized nations. On the other, higher prices and new incentives offer enormous potential for reducing energy use and costs.

The potential for energy efficiency only recently became recognized as a measurable "source" of energy, in the sense of saving energy that otherwise would be wasted. In large part this resulted from increased energy prices and from the availability of better information on energy consumption. Research on passive solar building design and energy use in existing businesses and homes has quantified the amount and cost of possible efficiency gains.

Federal energy information, initiated under the Nixon and Ford administrations and expanded by the Carter administration, has provided information on building characteristics. The government surveyed energy use in homes, commercial buildings, and industry, though only the residential and commercial surveys were completed. Prior to completion of the commercial survey, for example, no one knew the total square footage of existing commercial buildings or their energy use characteristics. Private industry has used this information to assess the market for energy efficiency services and products.

TABLE 8

POTENTIAL RENEWABLES CONTRIBUTION BY SECTOR

(Oil Equivalent Displaced in Quads)

Sector	Solar Thermal	Biomass*	Wind	Photovoltaics	Hydro	Total
BUILDINGS	1.9-2.3	1.0	.8-1.1	.4-.7		4.1-5.1
Residential	(1.6-1.9)	(1.0)	(.8-1.1)	(.3-.45)	—	(3.7-4.45)
Commercial	(0.3-0.4)	—	—	(.1-.25)	—	(.4-.65)
INDUSTRY	.5-2.0	3.5-5.5	—	—	—	4.0-7.5
AGRICULTURE	—	.1-.7	—	—	—	1.-.7
TRANSPORTATION	—	.4-5.5	—	—	—	0.4-5.5
UTILITIES	—	—	.5-3.4	—	3.4-3.7	3.9-7.1
TOTAL	2.4-4.2	4.8-10.5**	1.3-4.0**	.4-0.7	3.4-3.7	12.3-22.5**

*Biomass estimates are given in terms of oil displaced, rather than primary biomass supply.

**These columns do not add; high end of penetration is limited to less than total of potential applications in end-use sectors.

( ) = not additive within end-use sector.

SOURCE: Solar Energy Research Institute, A New Prosperity: Building A Sustainable Energy Future, (Andover, Massachusetts: Brick House Publishing Company, 1981), p. 7.

TABLE 9

RESIDENTIAL ENERGY CREDITS, 1980

	Conservation $1000s	Percent	Renewable Resources $1000s	Percent
NEW ENGLAND				
Connecticut	67,001		18.770	
Maine	21,400		680	
Massachusetts	190,230		36,134	
New Hampshire	12,657		1,067	
Rhode Island	21,555		1,177	
Vermont	8,555		2,368	
Total	321,398	10.1	60,196	13.6
MID-ATLANTIC				
Delaware	10,987		690	
Maryland	129,933		3,051	
New Jersey	188,612		7,530	
New York	346,519		7,213	
Pennsylvania	281,830		5,767	
Total	957,881	30.0	24,251	5.5
MIDWEST				
Illinois	166,068		35,067	
Indiana	61,707		2,922	
Iowa	44,719		2,719	
Michigan	120,243		1,415	
Minnesota	85,802		1,908	
Ohio	153,880		9,705	
Wisconsin	87,081		2,168	
Total	719,500	22.7	55,904	12.6
SOUTH				
Alabama	48,027		11,620	
Arkansas	22,861		2	
D.C.	10,043		46	
Florida	47,712		20,285	
Georgia	31,542		752	
Kentucky	24,884		3	
Louisiana	41,789		-	
Mississippi	24,821		-	
North Carolina	49,356		21,471	
Oklahoma	41,531		187	
South Carolina	29,820		229	
Tennessee	50,458		2,096	
Texas	111,767		2,667	
Virginia	48,572		3,313	
West Virginia	15,834		2,211	
Total	599,017	18.9	64,882	14.6

TABLE 9 (continued)

RESIDENTIAL ENERGY CREDITS, 1980

	Conservation $1000s	Percent	Renewable Resources $1000s	Percent
WEST				
Alaska	4,925		698	
Arizona	25,039		30,763	
California	147,691		107,312	
Colorado	61,540		10,226	
Hawaii	2,685		29,238	
Idaho	11,754		1,530	
Kansas	23,900		1,016	
Missouri	51,914		4,399	
Montana	10,641		765	
Nebraska	23,816		10,571	
Nevada	7,622		3,479	
New Mexico	9,762		12,232	
North Dakota	7,970		5,169	
Oregon	77,886		6,605	
South Dakota	6,672		1,005	
Utah	23,333		1,134	
Washington	68,504		6,461	
Wyoming	7,774		5,280	
Total	573,428	18.1	237,883	53.7
U.S. TOTAL	3,171,224		443,116	
	CONSERVATION (Percent)		RENEWABLE (Percent)	
NORTHEAST	40.3		19.1	
MIDWEST	22.7		12.6	
NORTHEAST AND MIDWEST	63.0		31.7	
SOUTH	18.9		14.6	
WEST	18.1		53.7	
SOUTH AND WEST	37.0		68.3	

SOURCE: Calculations based on Internal Revenue Service, Statistics of Income Bulletin, Volume 1, Number 3, Winter 1981-82 (Washington, D.C.: Department of the Treasury), p. 10.

Bipartisan support for the decontrol of energy prices during the Nixon, Ford, and Carter administrations was based in part on the assumption that higher prices would encourage energy efficiency gains. The Carter administration also established federal incentives for energy efficiency in 1978. Such efforts increased dramatically in 1979 and 1980 with the establishment of tax credits.[45] (See Table 10.)

Table 11 summarizes the potential energy efficiency resources available from existing technology by the year 2000. By comparing the Energy Information Administration's (EIA) projections for energy consumption in the year 2000 with the estimates provided by SERI, the dramatic differences become apparent. The projections are based on differing assumptions about the price of energy, national growth rates, etc., and are only "best" or most likely estimates, but they do highlight the tremendous potential for increased energy efficiency. The EIA estimates assume energy efficiency improvements under current market forces. SERI estimated the additional energy efficiency gains possible with limited federal support for information, technical assistance, tax incentives, federal research and development, and conservation programs currently proposed for reduction or elimination (such as the Solar and Conservation Bank, Residential Conservation Service, and federal support for state and local governments), and a reduction in federal subsidies for oil and gas production.

In 1980, the U.S. paid $378 billion for energy use; between 1980 and 2000 the U.S. will spend roughly $7 trillion on energy consumption. To order achieve the energy production goals projected by DOE, the U.S. will have to invest over $1 trillion.[46] SERI estimates that an investment of $750-800 billion would be needed to achieve its projected energy efficiency and renewable resource goals by the year 2000.[47]

The table indicates that present policies are inadequate to stimulate optimum efficiency gains, primarily because continued federal incentives for energy supply distort the energy marketplace and the replacement cost of present sources of energy is far more expensive than sources previously used. The cost of future energy sources is not reflected in present prices for a number of reasons:

- Domestic sources of easily accessible oil and gas are declining. Additional oil production, in particular, will be more expensive. It costs far more to drill for oil from floating platforms above the outer continental shelf, and secondary recovery processes are more expensive than primary ones.

- Investment in nuclear and synthetic fuel development has slowed due to capital costs that have risen to the point of limiting construction.

- Expanded use of nuclear and coal electricity generation have serious environmental impacts that require additional investment to ameliorate. In addition, other problems have arisen, such as poor quality control in the manufacturing of equipment, delays in construction of facilities because each big project is in many ways unique, and high labor costs, due largely to a shortage of qualified manpower and a decline in labor productivity.[48]

TABLE 10

FEDERAL ENERGY INCENTIVES, 1978-1983*
(in millions of dollars)

	1978		1979		1980		1981		1982		1983**	
	$	%	$	%	$	%	$	%	$	%	$	%
Fossil Fuel Supply												
Tax Expenditures	2,560		3,075		4,240		8,610		8,805		8,725	
Energy R&D	275		761		837		994		417		107	
Total	3,325	61.1	3,836	53.7	5,077	60.3	9,604	68.8	9,222	69.4	8,832	68.4
Nuclear	1,465	26.9	1,501	21.0	1,486	17.6	1,441	10.3	1,501	11.3	1,460	11.3
Solar												
Solar Energy R&D	394		485		561		657		248		83	
Tax Expenditures		7.2	155		234		530		760		875	
Total	394		640	9.0	795	9.4	1,187	8.5	1,008	7.6	958	7.4
Conservation												
Energy R&D	137		196		235		709		125		22	
Tax Expenditures		2.5	825		663		845		910		920	
Total	137		1,021	14.3	898	10.7	1,554	11.1	1,035	7.8	942	7.3
Power Marketing Authorities	122	2.2	146	2.0	165	2.0	175	1.3	523	3.9	711	5.5
TOTAL	5,443	100.0	7,144	100.0	8,421	100.0	13,961	100.0	13,289	100.0	12,903	100.0

* This is not as complete a list of federal energy incentives as included in the Battelle study. The largest omission is tax incentives to utilities, which was not available.

** Administration's proposed budget for fiscal 1983.

SOURCES: Office of the Budget, U.S. Department of Energy, "ERDA-DOE Energy Rand D," February 11, 1982; Office of Tax Analysis, U.S. Department of the Treasury, "Energy Tax Expenditures," December 1980; and Northeast-Midwest Congressional Coalition, A Regional Analysis of President Reagan's Fiscal 1983 Budget (Washington, D.C.: February 8, 1982), pp. 8-1, 8-6, 8-10.

All of these problems contribute to high cost overruns in utility plant construction. Interest and other charges climb as projects are delayed. Because many of the new technologies are large and costly, the benefits of cost reduction from the "learning curve" have not occurred, putting large-scale technologies at a distinct disadvantage.

The capital costs of the energy industry are high relative to many other sectors, but they are even higher for electric utility generation. The capital output ratio (the amount of capital investment required to produce a dollar of annual sales revenue) is $4.50 for electric utilities compared to $1.00 for other energy sectors and about $.60 for all manufacturing.[49]

Regional Implications

Federal tax incentives designed to help increase the efficient use of energy have benefitted areas faced with high energy costs and extreme climates. As shown earlier in Table 9, the Northeast, which is heavily dependent on petroleum as a fuel source, accounted for 40 percent of the residential energy conservation tax credits in 1980, followed by the Midwest with 23 percent. In 1980, an estimated 36 percent of the business energy investment tax credits went to the Northeast, 17 percent to the Midwest, 30 percent to the South and 17 percent to the West.[50] Similarly, the Northeast received 30 percent of the low-income weatherization funds in 1982, followed by the Midwest with 34 percent, the South with 16 percent, and the West with 21 percent.

Other federal energy conservation programs have been more evenly distributed. Of the funds for increased efficiency in schools and hospitals, 26 percent went to the Northeast, 25 percent to the Midwest, 26 percent to the

TABLE 11

PROJECTIONS FOR U.S. ENERGY CONSUMPTION
(in quadrillion BTUs)

Sector	Actual Consumption 1979	EIA Projection Year 2000*	SERI Projection Year 2000**
Residential	16.3	19.9	10.9
Commercial	11.8	15.4	7.2
Industrial	33.7	49.4	31.1
Transportation	20.2	19.5	14.5
TOTAL CONSUMPTION	82.0	104.2	64.0

* Assumes current market forces.
** Assumes use of existing efficiency technology.

SOURCES: Energy Information Administration, U.S. Department of Energy, 1981 Annual Report to Congress. Volume 3 Energy Projection (Washington, D.C., February 1982), p. 176. Energy losses distributed by sector according to Carleen Cornett, Economist, Short-term Forecasting, EIA, telephone conversation, March 17, 1982. Solar Energy Research Institute, A New Prosperity (Andover, Massachusetts: Brick House Publishing Company, 1981), p. 7.

South, and 23 percent to the West. Similarly, 23 percent of state energy conservation program funds went to the Northeast, 22 percent to the Midwest, 32 percent to the South, and 24 percent to the West (see Table 21 for a state-by-state breakdown of funds for these programs). Although these programs are more equitably distributed, they are funded at a much lower level than production incentives. The economic impact of efficiency programs will be discussed in greater detail in the following chapters.

Rural/Urban Impact

The impact of dramatic increases in the price of energy has been felt by all consumers -- rural and urban, farms and businesses. These energy price increases also have brought to light the bias of past federal energy policies.

A comprehensive federal energy policy must be based on a recognition of the impact on all sectors of the economy, not just on domestic energy producers. Past federal energy policies have supported and stimulated the economies of producing states, primarily in the South and West. Energy incentives for production have benefited rural producing economies and created job opportunities in those areas. Most of the future conventional energy reserves are located on federal lands in the West, in Alaska, and in other predominantly rural areas. Rural areas primarily in the South and West have benefited from hydropower development and the establishment of power marketing authorities and the Rural Electrification Administration. These programs account for much lower electricity rates, particularly in the Bonneville area, and for the fact that electricity prices generally are lower in rural areas than urban areas. In contrast, there are few federal energy incentives that enable or encourage urban areas to tap their energy efficiency or energy supply potential in a systematic fashion. Much of the older building stock is located in urban areas, and so is much of the potential for cogeneration and district heating. To utilize waste heat from industrial processes or electricity generation efficiently and effectively, cogeneration and district heating systems require a large potential for heat utilization near the source of waste heat, making them particularly suited to urban areas.

Many energy experts have pointed out that conservation is the United State's key energy source for the immediate future. It has been identified as the cheapest, safest, and most promising energy alternative available in large amounts. It can stimulate innovation, employment, and economic growth, and if aggressively pursued could reduce substantially the need for oil imports by the year 2000. Energy conservation potential is equivalent to an untapped pool of energy resources. As the following sections point out, it is the key "source" of energy available to urban areas, and if developed extensively would stimulate employment in local economies, cut down on high energy costs, and contribute to the revitalization of the nation's industrial base.

III. URBAN ENERGY NEEDS

Changing perceptions of energy supply and demand hold several important implications for urban areas. Urban areas, which often contain distressed central cities, have unique opportunities for energy efficiency, as well as special problems in tapping these opportunities. Decontrol of energy prices does promote conservation and efficiency, but optimum levels of investment in efficiency are frustrated by a lack of adequate information, high interest rates, lack of access to capital, and other market imperfections.

The potential for energy efficiency is particularly significant in urban areas, in which roughly two-thirds of the nation lives. Much of the older and less-efficient building stock is located in these areas, primarily in central cities. At a same time when high energy costs are consuming more of local disposable income, urban areas generally do not have their own conventional energy supplies. Thus, increased costs represent additional income that is lost to the local economy.

To better understand the relationship between cities and higher energy costs, New York City can be used as an example. In 1979, New York City paid $7.7 billion for energy use.[51] Over the next ten years it will spend roughly $88 billion (in constant dollars) for energy if it continues its current patterns of consumption. Roughly 60 percent of New York City's consumption occurs in buildings.[52] With only minimum energy effiency measures, $24 billion could be saved over the ten-year period, the New York Energy Office reported.

The city estimated that $4.5 billion of the $7.7 billion it spent on energy left the city's economy.[53] With an investment of approximately $3-4 billion in energy conservation, the report stated, the city annually would retain about $1 billion of that $4.5 billion in the local economy.

These conclusions were based on the assumption that residential energy consumption would be reduced 22 percent, resulting in savings of $595 million. Commercial sector consumption would be reduced 25 percent, saving $292 million. Low-cost energy efficiency measures in the industrial sector could reduce industrial consumption by 10 percent, or $111 million.[54] Federal, state, and local government facilities could reduce energy use by 28 percent, or $126 million. Seventeen percent of transportation energy -- $559 million -- could be saved through replacement of public and private transportation vehicles with more fuel-efficient models, increased efficiencies in the subways, and better implementation of the city's transportation policies.[55] Total savings would come to roughly $1.7 billion, with about $1 billion retained in the local economy. The Energy Office calculates that with the indirect effects of the money retained locally, up to $2.5 billion could be generated in local gross sales.[56]

Residential Sector

The reality of sharply increased energy prices has created several problems for urban areas. Higher household energy costs consume a growing share of low income household disposable income. In 1980, households in poverty spent an average of 32.4 percent of their income on energy costs. Households

at 125 percent of poverty spent 24.9 percent.[57] As a result, many low income households cannot pay fuel bills without assistance. Energy costs are expected to take a larger percentage of income over the next 20 years, according to the Department of Energy.

The percentage of a family's income spent on energy varies widely by state and region. In addition, the age of housing, the level of conservation, and particularly the type of heating fuel used account for wide variations in home heating costs. For example, families with an income of $5,000 or less in the Northeast spent an estimated $1,026 for oil heating in 1980 compared to $542 for natural gas. In the West, families with the same income spent $675 to heat with fuel oil, compared to $247 for natural gas.[58]

The number of persons in poverty has been growing in central cities and declining in suburban and rural areas, as shown in the following table. The rate of poverty in large central cities between 1969 and 1976 increased by 16 percent, compared to 3 percent decline in small central cities, a 15 percent decline in suburbs, and a 28 percent decline in nonmetropolitan areas. Poverty was growing at a time when central cities were losing population, resulting in the higher percentages of poor families. Rising poverty rates increase the strain on urban areas through increased demand for assistance and a lack of resources to cope with increased fuel prices.

The inability of low income residents to pay heating bills has caused problems for local governments. For example, in October of 1979, the Court of Common Council in Hartford, Connecticut, declared a public emergency after reviewing two studies linking rising energy costs to housing abandonment and displacement of residents. The court authorized the city to take all necessary steps to prevent the further displacement of any Hartford residents from their housing because of inability to pay for fuel.[59]

Rising energy costs have affected the rental housing sector adversely. In 1978, 91 percent of all rental property was located in urban areas.*[60] Approximately 26 million housing units, or 35 percent of all housing units, are rented.

A decade ago, energy costs accounted for only 5-7 percent of multi-family housing (more than four units) operating costs; now they account for 30-50 percent in New York City.[61] Generally, these higher fuel costs have been passed on to the tenants in the form of higher rents. However, many low income public housing units have been abandoned by landlords who cannot pass increased fuel costs on to tenants.

The New York City Energy Task Force concluded in a 1979 report that:

> During the last five years it has generally been accepted but never clearly demonstrated that escalating fuel costs are one of the many causes of abandonment. The world oil situation has become such that the evidence from actual building expenditures and economic escalation data indicate that as of 1979 escalating fuel costs have become the single most influential factor contributing to landlord abandonment.[62]

---

*Urban includes housing in places of 2,500 inhabitants or more as defined by the Bureau of Census.

Although there is no comprehensive report available on the recent number of housing abandonments in cities, there are indications that in some areas abandonment rates are significant. New York City reported a total of 14,000 abandoned rental buildings in poor neighborhoods in 1980.[63] Detroit reported that about 2,000 buildings a year are being abandoned. Detroit is virtually unique in that it has a high vacancy rate in multifamily housing (15 percent in 1980). The owners of this housing tend to be new owners who purchased the buildings recently when housing prices were depressed. They tend to be poorer than the average landlord and have little capital to invest in improvements or pay fuel bills.[64]

TABLE 12

POVERTY BY TYPE OF COMMUNITY, 1969 AND 1976

A. Rate of Poverty (in percentages)

Year	All Central Cities	Large Central Cities*	Small Central Cities	Suburbs**	Non-metropolitan Areas
1969	14.9	14.8	14.9	8.1	19.3
1976	15.8	17.1	14.4	6.9	14.0
Percent Change, 1969-1976	+6	+16	-3	-15	-28

B. Total Number of Poor (in thousands of persons)

Year	All Central Cities	Large Central Cities*	Small Central Cities	Suburbs**	Non-metropolitan Areas
1969	9,247	5,049	4,198	5,976	11,981
1976	9,482	5,446	4,036	5,747	9,746
Percent Change, 1969-1976	+3	+8	-4	-4	-19

*Large central cities refer to central cities of SMSAs with more than 1 million persons. Some fairly large central cities are not included in this category.

**The suburbs represent all metropolitan areas that are not central cities. These "metropolitan balances" include rural or unincorporated areas that do not fit a traditional "suburban" image.

SOURCE: U. S. Department of Housing and Urban Development, The President's National Urban Policy Report, 1980 (Washington, D.C., August 1980), p. 4-2.

Another problem facing urban areas is the reluctance of landlords to make efficiency investments in rental property. A number of political, financial, institutional, legal, and behavioral barriers contribute to the present low level of energy efficiency investments in multifamily housing. These problems are magnified for owners of low income rental housing, particularly in the Northeast, where many buildings are heated with fuel oil. High operating expenses attributed to high-cost fuel oil force many landlords into difficult financial positions, particularly when combined with rent control or renters who are unable to pay higher rents. For example, in the state of Connecticut, the maximum rent for an AFDC family of four in 1981 was $230 per month. A property owner renting an average unit to an AFDC household at that rate would be losing over $100 a month.[65] Yet many low to moderate income people can not afford higher rents.

The greatest financial barrier to investment in increased efficiency is the availability and cost of financing. Some lending institutions are reluctant to lend money for efficency improvements. Most federal loan programs, including DOE's Low-Income Weatherization Program, are primarily designed for owner-occupied structures of fewer than four units. When financing is available, it often is in the form of a second mortgage, which is unattractive to property owners. In addition, loans at 18 percent interest may increase the payback period as much as three to four years.[66]

There also are significant technical barriers to multifamily efficiency investment. Relatively little research has been done on the costs and benefits of conservation investments for multifamily structures. This lack of technical information and expertise is a crucial factor, since prudent investment requires accurate assessment of the rate of return. Similarly, few engineers have experience in auditing multifamily structures, and an insufficent number of contractors are experienced in installation.[67]

Most conservation programs to date have made little impact on rental housing.[68] For example, although 50 percent of Portland, Oregon, residents live in multifamily rental units, there is little evidence of landlord investment in increased efficiency. Of the 55,000 multifamily units served by two electric utilities, only 6 percent had been retrofitted for energy conservation by 1979.[69] A few areas recently have passed mandatory retrofit laws for rental housing (Portland, Oregon, the state of Minnesota, and Davis, California). However, mandatory retrofit laws without some financial incentives or loan mechanisms probably will be insufficient to encourage investment, especially in low income rental housing, where it is hard for landlords to recover the cost of investment by charging higher rents.

Older housing stock in urban areas, particularly central cities, adds to the problems faced by urban residents. New housing can be built with existing technology, which uses one-third to one-fifth the amount of energy per square foot. A combination of efficiency and solar technology could reduce total use in new buildings by 90 percent.[70] However, because housing stock is replaced more slowly than other durable goods (like cars and appliances), efficiency gains from "new models" will come relatively slowly to urban areas. For example, it has been estimated that 60 million of the 80 million housing units now in use still will be used in the year 2000.[71] A coordinated approach to retrofitting existing buildings is, therefore, particularly important for urban areas. A comparison of the age of housing stock and the rate of new housing construction shows higher proportions of older stock in urban areas

compared to rural and higher rates of new construction in rural areas (see Table 13). More of the housing stock is old and inefficient in the colder areas of the Northeast-Midwest region -- which has higher energy prices -- than in the South and West.

The cumulative effect of residential energy expenditures on an urban area can be significant. For example, 66 percent of Portland, Maine's housing stock was built prior to 1939 and 80 percent was built before 1960. The residential sector of Portland consumed roughly 41 percent of total city energy consumption in 1978. Expenditures for residential energy estimated in 1980 dollars came to $22.6 million. Five years earlier, Portland residents spent less than half that amount.[72] The severity of the problem is compounded by the fact that 41 percent of the city's population is low income (125 percent of federal poverty level).

Commercial Sector

Nationally, the average price of commercial energy (which includes institutions such as schools, hospitals, and government facilities) increased from $1,136 per billion BTUs in 1970 to $4,420 per billion BTUs in 1980.[73] This substantially higher cost has increased dramatically local governments' operating expenses, as well as those of schools, hospitals, churches, and other commercial buildings, which together consume about two-thirds as much energy as the total residential sector.

The problems created for the commercial sectors of urban area economies by these higher prices are similar to those found in the residential sector. Much of the building stock was built prior to 1970, an important factor affecting the efficiency of commercial energy consumption. Many older commercial buildings are relatively more energy inefficient than the housing stock. In 1975, for example, commercial buildings consumed 40 percent more energy per square

TABLE 13

AGE OF HOUSING STOCK, URBAN/RURAL
(in percentages)

	Northeast		North Central		South		West	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
-1939	49.5	33.6	41.0	45.0	18.3	18.0	27.1	30.4
1940-49	10.2	13.1	9.0	6.3	10.5	11.3	10.0	7.1
1950-59	16.9	12.1	20.1	11.9	22.4	16.0	17.7	11.4
1960-64	5.8	10.1	8.6	4.8	14.2	12.7	14.9	5.7
1965-69	5.4	11.0	6.2	17.9	14.4	18.9	11.7	18.2
1970-74	5.4	11.0	6.2	17.9	14.4	18.9	11.7	18.2
1975-	6.3	6.3	5.6	7.5	5.4	12.5	4.2	18.7

SOURCE: Calculations based on Energy Information Administration, Residential Energy Consumption Survey: Characteristics of the Housing Stock and Households, 1978 (Washington, D.C., February 1980), pp. 10-11.

foot than did residential buildings.[74] Energy consumption in various commercial buildings reflects differences in the number of people using the building, ventilation standards, lighting levels, architectural design, and use of equipment. Large commercial buildings tend to have different heating and cooling needs in the same building, for instance, in the middle of a building a concentration of equipment or people may require year-round cooling. Large glass structures built in a period of cheap energy may require excesive heating and cooling. Similarly, lighting levels in commercial buildings may be far in excess of actual requirements. Typical buildings constructed in the early 1970s required approximately four watts of lighting per square foot. Typical buildings constructed in 1980 required only two watts per square foot, and it is estimated that this could be reduced to .5-one watt per square foot by 1990.[75]

On the basis of several studies, SERI concluded that energy use in existing commercial buildings could be reduced by 50 percent using existing technologies.[76] It is possible to build new commercial buildings that use only a quarter as much energy per square foot as average existing commercial buildings. However, a survey of nonresidential building fuel characteristics and conservation practices indicated that retrofitting for conservation in nonresidential buildings is not widespread and the potential for efficiency improvements remains high. Moreover, conservation investments were more likely to occur in buildings occupied by the owner (49 percent) than in buildings in which owners were not occupants (32 percent).[77]

New commercial buildings probably will be built at a faster rate outside of central cities, possibly leaving the urban core at a competitive disadvantage and contributing to the out-migration of firms. In other words, if new commercial establishments use only one fourth as much energy as existing ones, firms could reduce their operating costs and sell their products and services at a lower price. Moreover, owners of the newer, energy- efficient buildings would have the competitive advantage in leasing office space.

Commercial space is projected to increase 57 percent by the year 2000, assuming that the services sector of the economy continues to grow more rapidly than the industrial sector.[78] By the year 2000, 53 percent of the total national commercial space will have been constructed in the previous 20 years, compared to only 38 percent of housing stock.[79] Despite the growth predicted for this sector in terms of total square feet, an effective energy efficiency strategy could reduce the total demand for energy in the commercial sector by the year 2000 by 30 percent.[80]

Industrial Sector

Energy is the capacity to do work and is available from many different sources. Much of the work accomplished in an industrial society involves the conversion of materials into useful products. Without energy our industrial society could not produce the quantity of products we consume. Human labor is the most expensive form of energy; industrialization has substituted inexpensive fuel energy for human labor. The problem facing our industrialized economy is how to sustain the present level of industrialization in a world of high-cost energy.

Only very recently have analysts begun a thorough study of the amounts of energy required to produce basic materials. Such studies are needed for us to

better understand the energy intensiveness of various kinds of production the national requirements for specific materials and opportunities for efficiency improvements that will minimize energy use in basic industries and new technologies.[81]

The industrial sector in the U.S. (including factories, mines, farms, and the construction industry) uses more than a third of the nation's energy. National average industrial energy prices increased from $628 per billion BTUs in 1970 to an estimated $3,959 per billion BTUs in 1980.[84] Most of the factories in the U.S. were built prior to 1974. The basic materials processing industries shown in Table 14 face particularly serious problems because they depend heavily on energy inputs.

Without significant changes in basic trends, nearly half of the equipment now used by these industries could still be in use in 2000. This would mean that U.S. industrial facilities would continue to lag behind Japan and Western European nations in efficiency for the rest of the century unless barriers to investment in energy efficiency are addressed. The U.S. uses 50 percent more energy per unit of value added compared to Western Europe and 80 percent more than the Japanese.[83] Increased energy efficiency and renewable resource use could reduce the average amount of energy consumed per unit of energy service by 26 percent.

Table 14

MANUFACTURING ENERGY USE
BY MAJOR MANUFACTURING SECTOR AND SERVICE CATEGORY, 1978*
(in quadrillion BTUs)

Service Category	Food	Paper	Chemicals	Petroleum	S,C,&G**	Metals	Other	Total
Mechanical Drive***	0.51	0.68	1.59	0.41	0.38	0.88	2.63	7.08
Electrolysis			0.44			1.08		1.52
Process Heat	0.75	1.85	2.02	3.30	1.12	1.47	1.59	12.10
Space Heat	0.03	0.03	0.01		0.02	0.04	0.24	0.37
Chemical Feedstock			2.52			0.07		2.59
Metallurgical Coal						2.10		2.10
TOTAL	1.29	2.56	6.56	3.71	1.52	5.64	4.46	25.76

*Energy consumption figures include energy losses in the generation and transmission of purchased electric power. Approximately 1.5 quads of wood residues are allocated to the total consumption of the paper and other forest products industries. Figures shown are exclusive of motor gasoline consumption in manufacturing.

**Stone, clay, and glass

***"Mechanical Drive" includes lighting and other overhead electrical uses.

SOURCE: Solar Energy Research Institute, A New Prosperity: Building a Sustainable Energy Future (Andover, Massachusetts: Brick House Publishing Company, 1981), p. 219.

According to EIA's survey of nonresidential buildings, manufacturing establishments accounted for 12 percent of the total building stock. Eight-seven percent of the plants used electricity for manufacturing and 16 percent used natural gas.[84]

Some communities are hit doubly hard by increased energy costs. As discussed in Regional Energy Economics, economists and energy experts have concluded that rising energy costs have hurt the automobile and, indirectly, the steel industries most. Heavy industrial cities such as Lorain, Ohio, are particularly threatened as the recession cuts into the steel and automotive industries. In Lorain over the last year, U.S. Steel has laid off 2,000 workers. This has increased the burden on the Lorain County Community Action Agency, which provided 1,300 applicants with fuel assistance last winter. Officials estimated that half the applicants were "new poor" -- formerly employed workers who could not find work and whose unemployment benefits were running out. The increased unemployment accounted for a reduction of $425,000 in city revenues.[85]

Firms are giving increasing attention to fuel costs in making decisions on which plants to close. Because fuel prices are higher in some regions and -- probably more important -- fuel costs are higher for older, less efficient plants, investment in energy-efficient practices for existing facilities is to the long-term economic future of older cities. Energy prices also are a factor in decisions affecting the location of new plants, which are relatively energy intensive. A recent study found, for example, that of the three industries studied (plastics products, electronic transmitting equipment, and electronic components), two considered energy prices the second most important factor (after wages) in making location decisions. For the plastics and electronic components industries, "the effect of energy costs on new birth activity is larger than one would expect on the basis of aggregate data on industrial energy expenditures. On the other hand, energy prices have very little effect on births of single-establishment firms in the low energy-intensive industries such as electronic transmitting equipment. Surprisingly, though, energy prices seem to have a substantial effect on the birth of new branch plants in this industry."[86]

The relative inefficiency of older industrial plants in urban areas, if not significantly improved, could continue to contribute to loss of manufacturing employment in central cities, further eroding their employment and tax base.

The following table shows the national total use of energy by sector for urban and rural areas. The total energy bill for metropolitan areas (SMSAs greater than 250,000) was $172 billion dollars in 1978. Rural areas paid $79 billion. For urban areas, transportation expenses were the highest at $64 billion followed by residential at $38 billion and commercial at $28 billion, with industrial close behind at $26 billion. In nonmetropolitan areas transportation costs were also the highest at $32 billion, followed by residential at $15 billion, industrial at $15 billion, and utilities at $9 billion.

In other words, transportation costs account for the largest segment of energy expenditures, followed by residential energy costs in both rural and urban areas. However, urban areas have a greater concentration of commercial activities, which result in higher energy costs than for industrial energy use. In rural areas, industrial energy costs account for a higher portion of energy

TABLE 15

U.S. ENERGY EXPENDITURES, 1978, BY CONSUMING SECTOR AND LOCATION
(in millions of dollars)

Metropolitan Areas	Population	Residential Total	Industrial Total	Commercial Total	Utility Total	Transportation Total	Total Expenditures
Core of large SMSA	≥1,000,000	13,158.4	8,353.1	11,045.5	3,818.5	22,912.3	59288
Fringe of large SMSA	≥1,000,000	7,819.3	3,491.7	5,172.8	3,117.9	10,339.2	29941
Medium SMSA	250,000-1,000,000	12,186.2	10,680.8	8,628.7	6,041.1	21,314.7	58852
Small SMSA	≤250,000	4,483.6	3,903.5	31,409.0	2,829.6	9,088.7	23714
TOTAL		37,647.6	26,429.8	28,256.0	15,807.0	63,655.0	171,795
Nonmetropolitan Areas							
Urbanized							
Adjacent to SMSA	≥20,000	3,936.2	4,050.6	1,735.7	1,685.2	7,048.6	18456
Not adjacent to SMSA	≥20,000	1,878.2	2,327.4	1,116.4	1,173.9	4,390.1	10,886
Less Urbanized							
Adjacent to SMSA	2,500-≤20,000	3,750.8	3,999.6	1,732.6	3,470.8	8,427.2	21,381
Not adjacent to SMSA	2,500-≤20,000	3,612.3	3,224.3	1,903.8	1,328.9	7,902.2	17,972
Rural							
Adjacent to SMSA	≤2,500	659.1	761.1	231.5	383.9	1,529.2	3,565
Not adjacent to SMSA	≤2,500	1,256.9	694.4	512.4	799.0	3,045.4	
TOTAL		15,093.5	15,057.3	7,232.4	8,841.6	32,342.8	78,568
U.S. TOTAL		52,741.1	41,487.1	35,487.1	24,648.7	95,997.7	250,363

SOURCE: Irving Hoch, Richard T. Carson, Jr., and Charles M. Paulsen, Nonmetropolitan Energy Use: Consumption and Expenditues in 1978, with Comparisons to Metropolitan Energy Use (Washington, D.C.: Resources for the Future, October 1981).

expenditures. Commercial energy costs represent a much small proportion. These differences point out the importance of energy-efficiency gains in residential and commercial buildings for urban areas. Industrial energy efficiencies represent a larger potential source of savings in nonmetropolitan areas.

Urban Energy Potential

Cities do have substantial "sources" of energy savings that could be developed, some of which are unique to urban areas, like district heating and cooling and municipal waste to energy plants.

District Heating and Cooling. Most electric generating systems are very inefficient. In 1981, 24.6 quads of primary energy were used to provide 7.2 quads of end-use electricity; a total of 17.4 quads was lost in generation and transmission.[87] Roughly two-thirds of primary energy is lost in generation as heat through steam and hot water, which is discharged into the atmosphere or rivers. District heating and cooling systems capture this waste heat for use in heating buildings or in industrial processes, increasing plant efficiency substantially.

Up to a third of the total U.S. energy demand for heating and cooling buildings could be met by district heating and cooling systems, reducing fuel consumption by about five quads. If roughly a third of this district heating and cooling potential were developed by the year 2000, the nation could save 1.5 quads of energy annually.[88]

Fuel savings of 15-35 percent are attainable through cogeneration, compared to the energy required to produce heat and electricity from different sources. The economies of cogeneration are particularly favorable in the basic materials industries, which tend to be operated year-round. The potential savings by 2000 from cogeneration in six industries -- food, textiles, pulp and paper, chemicals, petroleum refining, and steel -- is estimated at two quads annually.[89]

Municipal Waste to Energy. Rubbish that was considered useless only a few years ago can be used as a fuel for resource recovery plants. Urban waste can be converted to energy in the form of steam or electricity, or as a fuel supplement, such as a methane. At the same time, using waste for fuel can help reduce the need for increasingly scarce and expensive land for waste disposal. Resource recovery plants are relatively capital intensive projects that require prior sorting of waste. Potentially, they could provide a source of urban energy that is increasingly cost-effective.

New York City's Energy Office has estimated it could produce the equivalent of 25,000 barrels of oil a day from urban waste recovery plants. In Ohio, Akron's resource recovery plant has saved 300,000 barrels of oil annually since its opening in 1977[90].

Several problems have slowed the development of waste recovery plants, however. Many urban areas currently rely on natural gas, which is still under price controls. Although resource recovery plants are expected to be cost-effective in the future, initially it is difficult for them to compete with the regulated price of natural gas. Cities have had problems obtaining financing for this unconventional technology, and plant costs have, in some cases, ex-

ceeded initial projections, in part because of unexpected problems with new technologies.[91]

Renewable Resources. Small-scale hydropower, solar technologies, and to a lesser extent wind power are renewable energy technologies that can be adapted to urban areas. The solar technologies with the greatest potential for urban areas are passive solar building designs, solar hot water heating, and active solar heating.

Taken together, these sources of energy can be significant for cities. New York City's Energy Office, for example, estimates that American cities could produce the equivalent of 2 million barrels of oil a day from these sources (not including efficiency gains) in the next few years. A preliminary estimate of New York City's own potential was the equivalent of 100 million barrels of oil a year from the following sources:

- The equivalent of 25,000 barrels of oil a day could be produced from garbage in resource recovery plants.
- Solar hot water heaters could contribute a savings of 2 million barrels of oil annually.
- Two small hydroelectric plants are expected to displace 60,000 barrels of oil a day.
- Additional plants located on the city's water system could generate between 30-40 megawatts.
- The equivalent of almost 16 million barrels of oil is lost as waste heat from the electric generating plants located in the city. Although not all the heat could be used for other purposes, a substantial amount could be used in district heating systems to supply heat to residential and commercial high rises.[92]

Energy Efficiency "Supply" in Urban Areas. Conservation and renewable alternatives are the largest potential sources of energy available to cities. Table 16 below summarizes the estimated use of energy in urban and rural areas by sector in 1978.

The total consumption of energy reported by Resources for the Future for metropolitan areas in 1978 was 46.9 quads, compared to 24.8 quads in rural areas.[93] Roughly, then, metropolitan areas account for 65.4 percent of U.S. energy consumption. The potential energy efficiency "supply" available to urban areas with increased incentives* represents a significant amount, between five and ten quads annually by the year 2000 for residential and commercial use alone.[94]

The estimates for energy efficiency improvements and the development of other sources of urban energy supply reflect attainable goals given a balanced federal energy policy that recognizes the cost effectiveness of such sources

*As discussed in the SERI report. These include only "on the shelf" existing technologies that are cost-effective at today's prices. Incentives for using these technologies are discussed in greater detail later in the paper.

and their implications for urban development. Such a policy is needed to eliminate present market imperfections, which act as disincentives for investment in these sources.

Market Barriers

Substantial barriers now impede cost-effective energy efficiency investments. These are particularly significant in urban areas and include lack of reliable information and technical assistance, limited access to capital, restrictive building codes, and lack of incentives to improve energy use in multi-family housing and leased commercial space. Each of these problems is discussed below.

Lack of Information. A major barrier to increased energy efficiency investment is a lack of reliable information. In the last decade, significant progress has been made in developing cooperative public- and private- sector efforts to disseminate information and provide technical assistance. However, limited funding and the proposed elimination of many federal government programs, including most research and development programs in energy efficiency and renewable development, directly threaten this progress.

Without an evaluation of the effectiveness of programs and the provision of information needed to make cost-effective investments, cities will be unable to tap their potential for energy efficiency. A central source of information on what can be done needs to be made available to city and state officials to prevent needless duplication of programs or investments that are not cost effective. This would be a particularly important role for the Department of Housing and Development to continue and expand in the absence of a Department of Energy.

TABLE 16

ENERGY CONSUMPTION by SECTOR, 1978
(in quadrillion BTUs)

Metropolitan Areas	Residential	Industrial	Commercial	Electric	Transportation and Utilities	Total All Sectors
Core of large SMSA	2.658	2.806	1.975	2.156	4.954	14.576
Fringe of large SMSA	1.585	1.238	.878	1.991	2.134	7.826
Medium SMSA	2.362	4.600	1.584	4.005	4.675	17.227
Small SMSA	.910	1.565	.693	2.102	1.995	7.265
	7.542	10.210	5.130	10.254	13.757	46.894
Nonmetropolitan Area Total	3.017	6.298	1.490	7.324	6.691	24.821

SOURCE: Calculations based on Tables B1, B7, B13, and B19 in Irving Hoch, Richard T. Carson, Jr., and Charles M. Paulsen, Nonmetropolitan Energy Use: Consumption and Expenditures in 1978, with Comparisons to Metropolitan Energy Use (Washington, D.C.: Resources for the Future, October 1981).

Reductions in Research and Development. The Energy Research Advisory Board, a panel of energy experts who advise the secretary of energy, reviewed the proposed Fiscal 1982 budget for DOE research and development and reached the following conclusions:

> The overall level of federal R&D funding for conservation and improved utilization programs is too low in view of their potential for energy improvements and the inability of many important energy-consuming sectors to conduct R&D. Moreover, Department-wide, the balance between supply oriented R&D and conservation R&D is too heavily weighted toward the supply side.[95]

Generally, government and business lack good information on the use of energy in commercial and industrial buildings. National surveys on energy consumption and conservation investments in the commercial and industrial sectors have been or are in the process of being terminated. This slows the emergence of market information necessary for businesses to decide whether or not to move into the energy management business, or into retrofitting, or the manufacture of more efficient equipment.

Institutional barriers make federal research on buildings and community systems just as necessary. The Energy Research Advisory Board (ERAB) gave such research high priority. Recognizing its importance to the energy problem as a whole and to the oil import problem particularly, the Board noted that private sector R&D in this area is rare because of the fragmented and undercapitalized nature of the industries involved. The efficiency improvements that can be made in existing structures are large, and no R&D capability exists within the remodeling or retrofit private sector. A federal role is highly appropriate in this field.[96]

The untapped potential for efficiency resulting from the lack of R&D capability is a particular problem for many small- and medium-sized firms, which together consume large amounts of energy.[97] Foreign governments support research and technology development in these areas, so a slower rate of growth in energy efficiency in the U.S. would continue to damage the nation's ability to compete in international markets. The federal government should strengthen, not weaken its role in supporting research, development, and demonstration programs.

Schools, Hospitals and Local Government. As tax-exempt entities, these energy users have less of an incentive to invest in energy efficiency because they are not eligible for tax credits for such investments. Hospitals and some schools pass on the higher energy costs to patients or students. They also have limited access to capital. Tax increases, bond issues, and private-sector programs are constrained or not politically feasible at this time. Federal funding in these areas should be maintained to address these barriers.

Rental Housing. Landlords have few incentives to invest in energy efficiency. Either higher fuel bills are passed on to tenants through increased rents or, in rent-control situations, there may be a conversion to condominiums or a loss of building stock through increased abandonment. Renters have little reason to make efficiency investments if they are not directly responsible for paying energy costs. Landlords have little incentive

since they do not now qualify for conservation tax credits. For all these reasons, overall investment in rental units has been less than investment in privately-owned housing.

Financing. High interest rates make it difficult for commercial and industrial establishments to finance the needed investment in energy efficiency. Similar factors affect the ability of low and moderate income families to invest in efficiency. Figure 3 below shows the annual energy cost of conventional and energy-efficient houses. These costs includes fuel operation and maintenance, and loan payments on capital investment. The shaded area of the graphs shows the effects of high interest rate loans on the annual energy cost.

Most of the active efficiency potential lies in cogeneration and district heating and cooling, and most of the district heating and cooling potential and some of the cogeneration potential is located in urban areas. District heating and cooling and waste to energy projects are capital intensive. The Congressional Office of Technology Assessment found that the cost of capital represents 60-85 percent of the cost of district heating, depending on financing rates. These projects may be in the best interests of urban economic development, but the unavailability of capital presents a major barrier to their implementation.[98]

Conclusion

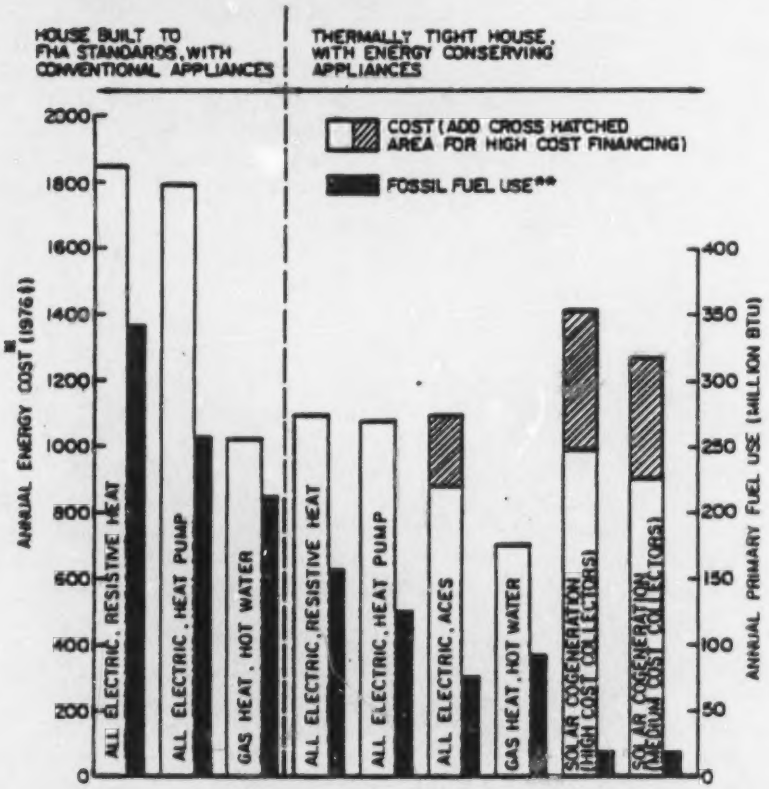
Urban energy efficiency represents a substantial potential "supply" of energy, amounting to five quads annually by the year 2000. Nuclear power, in contrast, would provide only about 3.5 quads of end-use electricity, according to current DOE estimates.[99] Yet federal incentives for nuclear power development in the 1983 budget came to $1.460 billion dollars, compared to $22 million for efficiency programs.[100] By reducing the need for imported oil, efficiency gains would have a positive effect on the national balance of trade, but they also would improve the competitive position of urban economies. High energy costs have tilted the balance of trade from energy consuming nations to energy producers and had the same effect on consuming and producing areas within the nation.

Moreover, higher energy costs have hit older industrial, more energy intensive, less energy efficient areas the hardest. Generally, they have had the most negative effect on areas that depend heavily on energy use for heating and cooling because of extreme climates. Higher costs long-term implications for the maintenance of older building stock, whether residential, commercial, or industrial. Yet the individuals and the businesses that are hit hardest have the fewest resources to invest in efficiency improvements. This is true also for cities. Those most affected by rising unemployment, increased demand for fuel assistance, and housing abandonment have the fewest resources to invest in programs that can begin to stimulate development of local energy sources. These are the areas that federal energy policies and programs should be designed to reach. Past and present policies have neglected both urban energy needs and urban energy potential.

Local governments have begun to recognize their role in taking more responsibility for local energy policies. Those with sufficient financial and other resources have explored the district heating and cooling potential in their cities, in part with assistance from the Department of Housing and Urban Development. Other cities have turned to potential waste to energy projects.

FIGURE 3.

ANNUAL ENERGY BUDGETS FOR SINGLE FAMILY RESIDENCE WITH ALTERNATIVE ENERGY SYSTEMS



*Includes fuel cost, operation and maintenance cost, and loan payment on capital investment

**The fossil fuel use shown is the fossil fuel use on-site plus the fossil fuel (or its equivalent) consumed to generate all electricity provided by conventional central station power plants.

SOURCE: Marc H. Ross and Robert H. Williams, Our Energy: Regaining Control, A Strategy for Economic Revival through Redesign in Energy Use (New York, New York: McGraw-Hill Book Company, 1981), p. 180.

Many have initiated local programs designed to provide information and technical assistance to individuals and businesses on energy efficiency measures. However, many barriers to increased investment in efficiency remain in the energy marketplace.

In this climate, few urban areas have the funds or the borrowing capacity to take advantage of urban energy "sources" such as cogeneration and district heating and cooling. Similarly, urban areas often lack the funds for sustained and systematic building efficiency programs, even those limited to providing information and technical assistance.

IV. INVESTMENT TRENDS AND EMPLOYMENT EFFECTS OF ENERGY CHOICES

The rapid increase in energy prices, coupled with federal incentives for the production of energy, has contributed to a substantial increase in capital investment in energy supply. The energy supply industry increased its share of total national plant and equipment investment from 21 percent in 1965 to an estimated 38 percent in 1981. It alone accounted for $121 billion of new plant and equipment expenditures out of a total of $184 billion in the industrial sector. In other words, energy supply made up roughly 65 percent of all capital and equipment expenditures in the industrial sector.[101] Clearly the energy supply industry is a healthy part of the U.S. economy. While increased domestic energy production is desirable, not enough attention has been paid to the effects of investment patterns in an era of escalating prices, especially in urban areas unable to take advantage of incentives for production.

Given the nature of conventional energy production techniques, urban areas benefit from supply incentives only indirectly. Because urban area economies for the most part cannot take advantage of production incentives, they have been unable to counter the significant out-flow of funds spent on energy and the concurrent multiplier effects of that out-flow. This drain of capital suggests that policies should be adopted to encourage urban areas to use those energy resources -- renewables and efficiency measures -- that are available to them.

In addition to the direct benefits associated with conservation, urban areas also can experience significant employment-related benefits from a program of investment in energy efficiency and appropriate renewable energy applications. While it is beyond the scope of this paper to attempt a comprehensive assessment of the employment impacts, this chapter does highlight significant differences in labor intensities between conventional energy technologies and efficiency investments. It concludes that the employment impacts of a program of investment in renewables and efficiency offer significant secondary benefits over and above the direct savings involved. If spent locally, the money invested to reduce energy expenditures also could have significant tax and multiplier effects on an urban area.

Direct Employment Effects of Energy Technologies

Table 17 summarizes the employment requirements for generating the equivalent of a trillion BTUs of electricity from a number of solar and conventional technologies, for each year of the system's life. Direct employment is defined as the labor requirements of energy production and delivery systems.

The labor intensity of energy efficiency and conservation techniques relative to conventional energy sources is shown in Table 18 below. The Council on Economic Priorities calculated the national employment per dollar expenditure for various energy sources by industry.

The direct employment effects of the various solar alternatives generally are greater than for conventional energy sources. Employment generated by conventional power plants is split between fuel production and power plant construction and operation, whereas solar technologies have a bigger impact on

manufacturing employment. Generally, large-scale conventional energy facilities are far larger than the largest solar energy system currently operable. Each site has peak employment requirements several times higher. The larger size means that fewer areas will experience employment gains from these sources. Natural concentration of fuels and significant economies of scale encourage concentrated development of conventional facilities, and probably no more than 250 of the nation's 3,069 counties can expect a new facility over the next 20 years.[102]

Solar, wind, and conservation systems, with their smaller size and diffuse energy sources, will be much more widely dispersed than conventional energy systems. Even though the construction phase of any one unit is short, other units will be needed in the vicinity, so that construction and installation employment would not show the pronounced peaking pattern of conventional facilities. In addition, some of the people who construct or install these systems can be expected to perform maintenance tasks as well, increasing the duration of employment in an area.

Moreover, the construction of large new facilities in rural or isolated areas (synthetic fuel plants, for example) can create boomtowns, as construction workers and their families migrate to the work area for a period of months or years. Populations in rural areas may expand significantly, placing considerable financial stress on local governments as well as other social and institutional structures.[103]

TABLE 17

ESTIMATES OF DIRECT AND INDIRECT EMPLOYMENT FOR SELECTED SYSTEMS
(employee hours per million BTU annual output)

System Type	Direct	Indirect	Direct and Indirect
Solar Heating/Cooling of Buildings			
Active hot water	2.8	5.6	8.4
Active heating	4.3	8.6	12.9
Active heating and cooling	5.0	10.0	15.0
Passive heating and cooling	1.7	2.8	4.5
Conventional Electric Systems			
Oil	1.65	0.99	2.64
Coal, low BTU	1.95	1.38	3.33
Coal, high BTU	1.68	1.17	2.85
High temperature gas reactor	2.55	1.44	3.99
Nuclear, light water reactor	1.38	1.62	3.0

SOURCE: Kenneth K. Smeltzer, Employment Impacts of Selected Solar and Conventional Energy Systems: A Framework for Comparisons and Preliminary Findings (Argonne, Illinois: Argonne National Laboratory, January 1980), p. 16.

Indirect Employment Effects of Energy Technologies

Indirect employment refers to the activity in the materials, supply, and service sectors necessary to provide equipment and systems intended for use in the energy system. For example, direct employment refers to employment in the manufacturing of mining equipment, but the labor necessary to produce component materials such as steel, glass, concrete, pipes, and wires is considered to be indirect employment. In other words, indirect employment results from spending by businesses on products and services of other businesses. Table 17 summarizes the direct and indirect employment effects of selected energy systems.

TABLE 18

NATIONAL EMPLOYMENT PER DOLLAR OF EXPENDITURE ON ENERGY CONSUMPTION, PCE,* AND CONSERVATION/SOLAR
(labor years per million dollars of expenditures)

Industry	Domestic Fuel Oil	Fuel Oil**	Electricity	Natural Gas	Mixed***	PCEs*	Conservation/ Solar
Agriculture	———	less than 0.05	———			2.3	0.2
Mining	1.9	1.1	1.4	1.7	1.3	0.3	0.4
Construction	0.7	0.4	1.4	0.9	0.9	0.7	19.0
Manufacturing	4.6	4.4	1.3	1.2	2.6	12.0	18.2
Transportation	1.7	1.2	1.2	0.3	1.1	2.1	1.2
Communications	0.2	0.2	0.2	0.1	0.2	1.0	0.3
Public Utilities	0.3	0.3	10.7	7.4	5.2	0.6	0.2
Wholesale & Retail	3.0	3.0	0.8	0.5	1.9	15.2	3.3
Personal & Professional Services	3.2	3.2	1.9	2.0	2.5	14.8	5.7
Gov't Enterprises	0.3	0.3	4.8	1.0	2.2	1.1	0.4
Total	16.1	14.1	24.0	15.5	17.7	50.3	48.8

Note: All employment is on site plus multiplier.

*Personal Consumption Expenditures.

**Adjusted to reflect 51.4 percent importation from foreign countries to the Nassau/Suffolk County, New York, region. The total impact would be 16.1 labor years, assuming the national average dependence on imported oil.

***Represents a mix of fuel oil (49.6 percent), electricity (39.3 percent) and natural gas (11.1 percent) expenditures. This is the mix of energy resources that would be conserved through implementation of the conservation scenario.

SOURCE: Steven Buchsbaum and James W. Benson, Jobs and Energy. The Employment and Economic Impacts of Nuclear Power, Conservation, and Other Energy Options (New York, N.Y.: Council on Economic Priorities, 1979).

In a more simplified survey, the capital investment per employee was calculated for various industries. Petroleum and public utilities were found to be by far the most capital intensive industries, with investment per employee more than five times the average for manufacturing, and approximately ten times that of wholesale and retail trade and services.[104]

The effect of a loss of disposable income as a result of a shift in consumer spending was analyzed by the Council on Economic Priorities. When the national employmnt effects of spending $1 million dollars on average consumer purchases is compared with the effect of spending a million on oil, electricity, and natural gas consumption, significant differences emerge:

- o average consumer spending of $1 million on goods and services results in 50 labor years of employment;
- o expenditures of $1 million on oil consumption result in 14 labor years of employment, a reduction of 72 percent compared to consumer spending on goods and services;
- o expenditures on electricity produce 24 labor years, or a reduction of 52 percent;
- o expenditures on natural gas result in 16 labor years, or a reduction of 68 percent.
- o expenditures of $1 million on conservation and solar measures would create 49 labor years.[105]

In addition, the local employment impact is substantially different. A detailed employment impact study for Nassau and Suffolk Counties on Eastern Long Island showed that investment in conservation and solar would result in 2.8 times as much local employment (48.8 labor years compared to 17.7 labor years) as for energy consumption.

The major reason for these different employment effects is that oil, gas, and electricity are capital intensive, and roughly a third of the employment impact is in energy producing areas of the country. The industries that supply plant and equipment for the energy industry are relatively capital intensive as well, resulting in low employment gains from additional energy production investment. As a result of different equipment and materials requirements manufacturing employment actually would increase by 15.6 labor years if $1 million were invested in conservation and solar rather than energy consumption.[106]

Induced Employment Effects

Induced employment occurs when employees and owners of businesses involved in direct and indirect employment spend their income. The comparative effects of different energy sources on induced employment have not yet been determined. In general, a dollar spent on consumer goods creates more employment than the same amount spent on energy consumption.[107] Retail, service, construction, and manufacturing sectors that provide consumer goods generally have higher employee-to-expenditure ratios than energy sectors. Increased energy costs decrease the amount of income used to buy other goods and services and thus decrease nonenergy employment. Conversely, decreased energy prices will result

in increased employment due to spending in sectors whose indirect employment multiplier is higher than that of the energy producing sectors.

Conclusion

The employment effects of conventional energy systems differ from those of solar sources and energy efficiency investments. Although each type has different employment effects, energy efficiency and solar systems generally are more labor intensive, both in direct and indirect employment effects. They also create more manufacturing employment than conventional technologies, and have no effect on fuel supply employment, which represents roughly a third or more of the employment effects of conventional energy sources. Employment in conventional technologies tends to be concentrated in a few places and is characterized by high peak employment of relatively short duration. Efficiency and solar technologies, on the other hand, are characterized by localized employment effects and would be dispersed roughly according to population. Energy efficiency and solar energy technologies are well suited to community-based enterprise and small business. Because high unemployment is a substantial problem in many urban areas, the employment effects of energy investments are an extremely attractive secondary benefit associated with reductions in total energy expenditures.

V. THE REAGAN ADMINISTRATION'S ENERGY POLICIES

The Reagan administration's energy policies mark a departure from past federal energy policies, and place a heavy reliance on a combination of market forces to influence consumption and federal incentives to spur production.

Specifically, the administration intends to continue to deregulate energy prices, reduce regulatory control over the energy marketplace, and accelerate the leasing and exploration of energy reserves on federal lands. The administration also is committed to opening up public lands for exploration and production. Public lands contain an estimated 85 percent of the nation's oil reserves, 40 percent of natural gas, 40 percent of uranium, 35 percent of coal reserves, 85 percent of the tar sands, 80 percent of oil shale, and 50 percent of geothermal resources.[108] The administration expects to preserve the tax provisions enacted in the 1981 Economic Recovery Tax Act that are supposed to serve as incentives for producers of energy. At the same time, officials have called for repeal of tax provisions and reductions in direct spending programs that promote more efficient use of energy by businesses and individuals. These policies would continue the urban and regional effects of past federal policies, channeling economic benefits to areas of production and away from areas that could benefit substantially from incentives to increase supply by efficiency efforts.

The administration recognizes that past federal policies have relied heavily on federal subsidies, controlled prices, and regulations, which inhibited energy efficiency and domestic energy production and encouraged reliance on imports. It prefers instead to allow market forces, rather than federal policy, to establish the price and availability of energy and thus help determine the level of private-sector investment in exploration, production, and refining. As evidence of the effectiveness of the policy, officials point to the oil drilling industry, where higher prices have stimulated investment in domestic exploration and production. In 1979, drilling was higher than it had been for 15 years, and it increased more in 1980. In the four-and-one-half months following oil price decontrol in January 1981, 575 more wells began operating and oil well completions were 41 percent higher for January-April 1981 than the same period a year earlier.[109] However, the early months of 1982 saw significant declines in both exploration and oil well completions.

Although the administration considers the wise and efficient use of energy resources to be a key element of national response to the world energy situation, it proposes to reduce substantially or eliminate programs that encourage more efficient use of energy. President Reagan also has reversed previous administration policies and programs to expand the development and use of nonconventional energy resources, such as solar technologies and efficiency. Instead, the administration is reducing funds and concentrating them on research and development in promising areas with high risk but high potential payoff, primarily synthetic fuels and nuclear technologies (see Table 10). OMB claims that private industry "can and will" provide the funds for near-term development, demonstration, and commercialization efforts.[110]

The administration has proposed a substantial reduction in personnel and funding for its information-gathering programs in the energy sector. The

resident's proposed budget for fiscal 1983 for EIA, which currently runs these activities, calls for eliminating the government's ability to forecast future energy production and consumption, conduct surveys of energy use in the commercial, industrial, and residential sectors, and provide state-level petroleum price, supply, distribution, and marketing information. This reverses the efforts of Presidents Nixon and Ford, who took steps to ensure a more comprehensive approach to energy and to establish a federal energy information agency, largely in response to public concern over the potential pitfalls of national energy policies established on the basis of information, analysis, and advice supplied solely by private industry with no independent analysis by government officials. If implemented, the reductions proposed by the administration would represent a rejection of past bipartisan support for an independent data collection authority and analytical capability within the federal government. Similarly, the administration's proposal to dismantle the Department of Energy and disperse its responsibilities to four other agencies represents a departure from previous policy, which emphasized the need for a comprehensive approach. This could reduce significantly the visibility and effectiveness of traditional federal energy conservation programs.

Oil and Gas Production Incentives

In striking contrast to its policy stance on conservation and renewable energy technologies, the administration intends to rely on several policy tools to influence the market to spur domestic production of both oil and gas, including immediate deregulation of oil prices, eventual deregulation of natural gas prices, increased tax incentives specifically for oil producers, accelerated exploratory leasing of public lands, and reduction of regulatory burdens. Several energy tax incentives currently are available to both producers and consumers of energy. OMB estimates that tax incentives for energy producers in 1983 will total $8.5 billion: $5.9 billion for the expensing of exploration and development costs and $2.9 billion for percentage depletion allowances. Consumers, on the other hand, will receive one-fifth as much: $0.9 billion in residential energy tax credits and $0.8 billion in business energy tax credits. The Reagan administration proposes to raise revenues by eliminating all business energy tax credits and repealing special provisions allowing cities and states to issue tax-exempt industrial development bonds to finance low-head hydro and other energy projects.

Congress established expensing of exploration and development costs and the percentage depletion allowance to stimulate energy production during a period of relatively low prices. However, energy prices now have been decontrolled to stimulate domestic production. Continuation of federal production incentives, when prices have been decontrolled is counter to the administration's reliance on market forces. At the same time, despite existing market barriers to energy efficiency and renewable resource development, federal programs disigned to counter act these market imperfections are being reduced. If this imbalance is not corrected, federal energy policies will continue to be heavily biased against urban areas.

Coal Policy

The administration intends to rely on reduced regulation, expanded leasing federal lands, and the higher prices resulting from the decontrol of oil and gas to stimulate coal production and use. Specifically:

- It expects the private sector to invest in mining, inland transportation, handling, and ocean transportation facilities needed for expanded coal exports, and to finance the costs of port and channel improvements by user fees.

- It will accelerate the leasing of coal-bearing lands in the West and eliminate redundant regulations. The states and private industry will have responsibility for the development and maintenance of coal transportation systems, including slurry pipelines and coal-hauling roads.

- Federal funding for coal technology will focus on long-term, high-risk research and development where there is an expectation of long-term payoff.

Nuclear Power

The administration points out that the development of nuclear energy has been constrained by the artifically low price of other fuels and the added cost and time resulting from government regulatory procedures and high interest rates. The administration is committed to providing a more favorable climate for nuclear power production and to enhancing nuclear's ability to compete in the marketplace with other potential sources of energy.

Under the administration's policies, the federal government will keep responsibility for two areas affecting the future role of nuclear power: proper disposal of highly radioactive or very long-lived wastes, and development of breeder technology to a point where commercialization is feasible. It also will provide for a breeder reactor demonstration and reprocessing of spent fuel by either the private or the public sector.

Electricity Generation

In the area of electricity generation, the administration is reviewing licensing activities, fuel use stipulations, and environmental restrictions, with an emphasis on streamlining procedures, eliminating costly delays in construction, and rescinding ineffective and unnecessary regulations.

Despite its general free-market stance, the government would, under the administration's current and proposed policies, continue to subsidize electricity rates in most Southern and Western states. In 1983, the federal power marketing authorities would receive substantial increases under the president's proposed budget (see Table 20). Besides continuing to subsidize the electricity rates of most of the South and West, the federal government will provide energy consumers within the boundaries of the Bonneville Power Marketing Authority (BPMA) with access to over $1 billion in conservation and renewable energy assistance. As a result of recently enacted legislation (P.L. 96-501), BPMA will acquire $1.25 billion in borrowing authority for loans and grants for energy efficiency and renewable resource development. This has created a situation in which the residents of a region with the lowest energy costs have access to a substantial amount of federally subidized grants and loans for conservation and renewables.

Synthetic Fuels

The president has proposed no cuts in the Synthetic Fuels Corporation, which will rely more heavily on private investment and initiative and less on public funds to stimulate synthetic fuel production. Funding for demonstration projects that do not receive significant private-sector support will be discontinued. If Congress broadens the authority of the corporation to include district heating and cooling systems and renewable resource projects, urban centers around the country would derive substantial benefits.

Renewable Energy Sources

The administration is relying on rising energy prices, elimination of some federal subsidies for conventional fuels, and DOE's focus on long-range research to encourage private-sector investment in renewable energy production. The administration proposes to rescind the appropriation of $22 million for the Solar Energy and Energy Conservation Bank in fiscal 1982 and to eliminate it in 1983.

Conservation

Although administration officials acknowledge that efficiency gains in energy use form an important element of our national response to the world energy situation, they believe that higher prices resulting from decontrol will suffice to stimulate conservation. Therefore, the president has proposed to cut conservation programs by over 83 percent. Under the Department of Energy dismantlement plan, $17.5 million would go to the Department of Commerce to conduct energy conservation research and $4.3 million would be used to close out the state and local conservation grant programs. The proposal would eliminate funding for the low income weatherization program, the schools and hospitals program, and the state energy conservation program, all of which provide important support to the states in the Northeast-Midwest region (see Table 21).

TABLE 20

BUDGET AUTHORITY OF FEDERAL POWER MARKETING AUTHORITIES
(in millions of dollars)

	1982	1983
Alaska Power Administration	3.5	2.8
Southeastern Power Administration	7.2	11.8
Southwestern Power Administration	21.3	34.3
Western Area Power Administration	210.8	207.2
Bonneville Power Administration	279.7	455.0
Total	522.5	711.1

SOURCE: Northeast-Midwest Institute, A Regional Analysis of President Reagan's Fiscal 1983 Budget (Washington, D.C., February 8, 1982), p. 8-10.

Table 21
SELECTED ENERGY CONSERVATION PROGRAMS, FISCAL 1982
(in thousands of dollars)

State and Region	Weatherization	Schools and Hospitals	State Energy Conservation Program	Low Income Energy Assistance Program[3]
NEW ENGLAND				
Connecticut	2,031.7	798.9	358.7	36,654.8
Maine	2,279.8	454.7	186.8	23,746.5
Massachusetts	4,385.3	1,348.1	514.4	73,321.7
New Hampshire	1,085.0	391.8	174.5	13,878.3
Rhode Island	869.8	355.1	192.5	12,069.2
Vermont	1,073.9	299.5	151.4	10,402.3
Total	11,725.5	3,648.0	1,578.3	170,072.7
MID-ATLANTIC				
Delaware	384.9	253.4	154.2	4,865.2
Maryland	1,653.3	890.5	438.0	28,066.1
New Jersey	3,797.4	1,552.7	806.2	68,067.8
New York	15,031.7	3,685.4	1,416.7	222,251.7
Pennsylvania	10,310.0	2,488.9	882.3	119,381.9
Total	31,177.3	8,870.9	3,697.4	442,632.8
MIDWEST				
Illinois	8,736.6	2,591.1	1,069.0	101,454.1
Indiana	4,112.3	1,261.8	666.3	45,935.6
Iowa	3,573.2	834.2	359.6	32,555.2
Michigan	10,167.6	2,223.5	840.5	96,321.8
Minnesota	7,533.2	1,292.2	484.1	69,394.4
Ohio	8,405.6	2,318.5	1,035.1	89,751.3
Wisconsin	5,596.4	1,307.9	527.4	62,464.9
Total	48,125.0	11,829.2	4,982.0	497,877.4
NORTHEAST	42,902.8	12,518.9	5,275.5	612,705.6
MIDWEST	48,125.0	11,829.2	4,982.0	497,877.4
NORTHEAST and MIDWEST	91,025.8	24,348.1	10,257.7	1,110,582.9
SOUTH	22,629.2	12,547.3	7,410.4	299,503.9
WEST	29,383.0	10,939.8	5,498.8	336,517.1
SOUTH and WEST	52,012.2	23,487.1	12,909.2	636,021.1
U.S. TOTAL	143,038.0	49,000.0[1,2]	24,000.0[1]	1,749,000.0[4]

[1]Includes expenditures for Puerto Rico and the territories.
[2]These are DOE estimates. The actual appropriation was $48 million.
[3]As of February 6, 1982, only 90 percent of these amounts had been distributed to states.
[4]Includes funds for Puerto Rico and other territories.

SOURCE: Department of Energy, unpublished data, 1982.

VI. NEW DIRECTIONS FOR FEDERAL ENERGY POLICY

The following policy alternatives highlight some of the many steps Congress can take to balance the federal energy budget. The alternatives are organized around four major policy areas: federal and state energy tax relationships; block grants; the Synthetic Fuels Corporation, and production and conservation programs.

Federal and State Energy Tax Relationships

Present tax policy is biased heavily in favor of producers of fossil fuels, primarily oil and gas. The two largest tax expenditures (the percentage depletion allowance for oil and gas and expensing of intangible drilling costs) were designed to encourage domestic production in periods when prices were low prior to the oil embargo of 1973-1974, and were continued during the period of price regulation. With the deregulation of oil prices in 1980, these tax incentives no longer are needed; at present they distort the energy market. Congress should adjust these tax incentives to make them more equitable or eliminate them. Among the options available to Congress:

- Repeal the percentage depletion for "independent" oil companies.

Under current provisions, non-integrated "independent" oil companies can deduct 18 percent of their gross income as a "percentage depletion allowance" for as long as a well is producing. This means that these companies can shelter not only the return of their capital but part of their profits as well. When combined with intangible drilling costs, the depletion allowance permits the expense of the well to be written off many times during its producing life. As a result, many companies use percentage depletion in conjunction with other tax breaks to pay virtually nothing in taxes on very large earnings. The Congressional Budget Office (CBO) estimates that repeal would produce $9 billion in additional revenues over the 1983-1987 period.

- Repeal expensing of intangible drilling costs.

Oil and gas drilling costs are 75-90 percent tax deductible, allowing companies engaged in these activities to effectively defer their taxes on income in much the same manner as an interest-free loan. The expensing of intangible drilling costs is an inefficient subsidy, as it applies equally to low-risk drilling in proven fields as well as high-risk exploratory drilling. If intangible drilling costs were capitalized, the costs of dry holes could be written off under normal accounting procedures; this would continue to encourage exploration. Expensing of intangible drilling costs also applies to major oil companies, reducing their effective tax rate by as much as 6-7 percentage points. Repeal of this provision would result in $38 billion in additional revenues over a five-year period, the CBO estimates.

- Amend the Windfall Profit Tax Act.

Several provisions in the Economic Recovery Tax Act of 1981 reduced federal revenues from the windfall profit tax. The major changes included an increase in tax credits on royalties, the phased reduction from 30 percent to

15 percent in the tax rate imposed on newly discovered oil, and the exemption of independent producer stripper oil from taxation. Repeal of these amendments would increase federal revenues by $11.7 billion in the next five years.

o Consider a windfall profit or excise tax on natural gas.

Natural gas price controls are scheduled to run out on January 1, 1985, under the Natural Gas Policy Act of 1978. The administration intends to ask Congress for legislation accelerating decontrol. Any deregulation of wellhead natural gas prices could result in large increases in consumer gas prices and, subsequently, producer profits. A tax on natural gas profits could be established, with funds returned to the states for energy efficiency and renewable resource development. It is difficult to project the net profits of producers and the net revenues to be gained from such a tax. However, the CBO estimated that if all wellhead gas prices were deregulated on January 1, 1983, an excise tax of $.60 per thousand cubic feet would raise approximately $11 billion per year after 1984.

o Establish a national severance tax.

One option would be to impose a national severance tax on oil and earmark part of the revenues for programs with a regionally equitable allocation pattern. Representatives Howard Wolpe (D-Michigan) and Claudine Schneider (R-Rhode Island) have introduced H.R. 6330, the National Crude Oil Profit-Sharing Act, to correct some of the present problems in energy tax policy. The bill would levy a 30 percent tax on domestic crude oil and place a cap on state severance taxes. Twenty-five percent of the revenues raised under the bill would flow into a trust fund to finance state energy and economic development block grants, with the remainder going to the general fund to reduce the deficit.

o Revise federal royalty arrangements on energy production.

Present federal policies regarding royalties and energy development generate little revenue for the federal government. The standard on-shore royalty for oil, natural gas, and coal produced from federal land is 12.5 percent, which is split 50/50 with the state of production. The federal treasury then allocates 80 percent of its share to the Reclamation Fund, which also flows back to the state of production. Thus the federal government retains only 10 percent of the royalties derived from on-shore federal energy production. Also, the policy of leasing federal land to private firms allows the states to apply severance taxes to resource production from federal land. The one exception is in the case of royalties and other charges on outer continental shelf (OCS) oil. The OCS standard royalty is 16.66 percent and is retained as general revenue. Federal on-shore royalty arrangements could be reformed by adopting the OCS royalty regime.

On the tax policy side, current tax incentives for conservation and solar energy for homeowners and businesses should be continued. Tax incentives designed to spur landlord investment in rental property should be implemented. Other options available to Congress:

o Provide tax credits for passive solar.

Tax credits should be expanded to include incentives for construction of passive solar homes. Such a measure would complement present tax credits for active solar systems and would spur the use of passive solar designs.

o Expand the tax credits for geothermal energy.

Tax credits should be extended to geothermal waters under 120°F. Current policies exclude the cooler geothermal energy of many Northern states.

o Increase energy investment tax credits.

The energy investment tax credit for industrial cogeneration equipment and recycling equipment for resource recovery plants is scheduled to expire at the end of 1982. These tax credits could be continued to spur investment in cogeneration.

An Energy Block Grant

o An energy block grant should be established that would give the states discretion to promote the most effective energy resource potential in the state.

Under such a program, states could support low-head hydro; a retrofit loan program; synthetic fuel development; fossil fuel production; district heating and cooling projects, or biomass development. The allocation formula for block grant funds should be based on:

1) the weighted average price of energy in the residential, commercial, and industrial sectors;

2) the number of heating and cooling degree days; and

3) population.

This program would reflect the diversity of potential energy sources and return responsibility for energy policy to the states while providing needed capital for projects.

Production and Conservation Programs

o Establish a Northeast-Midwest Federal Power Marketing Authority.

A Federal Power Marketing Authority should be established in the Northeast-Midwest region, the only region currently without one. Partially because of the activities of federally supported power administrations in other regions, their electricity rates are significantly lower than those in the Northeast and Midwest. This region has an abundant but underutilized source of energy in its river systems. The Army Corps of Engineers estimates that the states of the Northeast and Midwest contain half the nation's feasible hydro sites and 20 percent of the potential hydro generating capacity. Yet, despite the real potential of small-scale hydropower to reduce high energy costs and dependence on foreign oil, it remains a largely untapped resource in the region. Lack of access to affordable financing is the main obstacle.

A proposed Northeast-Midwest States Federal Hydropower Financing Authority (S. 1918), sponsored by Senators Arlen Specter (R-Pennsylvania), and Donald W. Riegle, Jr. (D-Michigan), would help the region deal with the legal, financial, and operational obstacles confronting small-scale hydropower development. States in the Northeast-Midwest region would have the option of joining the regional power marketing authority and thereby becoming eligible to apply for loan guarantees offered at the cost of borrowing by the Treasury Department. These loans could cover up to 70 percent of the costs associated with hydropower development at existing small-scale sites. State and municipal power authorities, rural electric cooperatives, interstate river commissions, and consumer- and stockholder-owned electric utilities located in member states could have access to financing through the regional authority.

o Increase the state role in energy production policies.

As pointed out earlier, energy efficiency improvements offer the largest source of potential energy "supply." Increased responsibility for energy policy at the state and local levels should be accompanied by federal support for state energy information, technical assistance, state and local energy offices, and energy block grants to develop state resources. The federal government should help the states monitor, evaluate, and exchange information on conservation and solar loans and other financial assistance programs. This would include comparative studies of efforts using different approaches.

o Encourage energy efficiency measures in public housing units and rental properties.

Substantial energy savings can be achieved by weatherizing existing buildings. The Department of Energy's weatherization assistance program does not adequately address the needs of urban areas because multi-family residential units are not eligible for assistance. The federal government should help localities design programs to address peculiarly urban needs. For example, the Department of Housing and Urban Development's role should be expanded to provide technical assistance on building efficiency measures. The department also should provide state and local governments with better information on building energy performance, energy costs, and efficiency measures.

o Activate the Solar Energy and Energy Conservation Bank.

The funding of the Solar Energy and Energy Conservation Bank should be increased at least to initially authorized levels. Priority should be given to getting the bank into operation and using the full funding authority and flexibility of the bank to provide needed financial assistance for solar and conservation measures.

o Balance research, development, and demonstration programs.

To restore balance to the current energy research and development program, funding for conservation and renewable resources research and development should be expanded, not cut. In particular, research on buildings and community systems should be given high priority. Federal coal research should be continued to encourage innovative air pollution abatement technologies, such as coal cleaning and fluidized bed combustion.

o Encourage district heating and cooling and cogeneration.

The federal government should continue to expand its role in assisting local government analysis and implementation of district heating and cooling and cogeneration projects. This could be done through a specific HUD program funded for this purpose, or at an urban area's discretion, using its portion of a proposed energy block grant.

o Broaden the Synthetic Fuels Corporation.

The Synthetic Fuels Corporation (SFC) was established in 1980 with $17.5 billion dollars in budget authority to encourage the production of synthetic fuels in order to reduce U.S. reliance on imports. However, because the corporation is authorized to consider only synthetic fuel development from fossil fuels such as oil shale and coal, it ignores the potential contribution of urban energy sources. It also perpetuates the present regional bias of federal energy policies; all of the projects considered for funding in the first round of proposals were located in the South and West. The Energy Security Act of 1980, which established the SFC, should be amended to include district heating and cooling systems and municipal waste to energy projects.

H.R. 5833, introduced in the House by Representatives James L. Oberstar (D-Minnesota) and Claudine Schneider (R-Rhode Island), and a companion bill in the Senate (S. 2619), sponsored by Senators David Durenberger (R-Minnesota), Paul E. Tsongas (D-Massachusetts), and Donald W. Riegle, Jr. (D-Michigan), would:

1) broaden the lending authority of the SFC to include district heating and cooling. These projects would be eligible for all forms of financial assistance available from the corporation.

2) amend the Energy Security Act to provide price support loans for municipal waste to energy projects.

3) stipulate that 25 percent of the financial assistance available from the SFC be directed to district heating and cooling and municipal waste to energy projects (House bill only).

4) require the board of directors of the SFC to assure that the corporation is organized and staffed so as to effectively evaluate, process, and review applications for district heating and cooling and municipal waste to energy projects.

o Balance incentives for coal production.

Coal represents over 80 percent of the nation's fossil fuel reserves. With the right technology, it can burn cleanly. With an expanded and improved transportation system, it can compete in domestic and foreign markets. The debate over coal's future is clouded by coal's present: disagreement over the causes and effects of acid rain; uncertainty about the environmental and health impacts of synthetic fuels, and questions concerning the fairness of the 1977 Surface Mining and Reclamation Act. Federal energy policy should be balanced with regard to relative subsidies applied to potential sources of energy. Past energy policies favored oil and gas production over coal. These biases should be removed. Federal policy should support improved and expanded transportation

facilities to carry coal. Ports must be modernized and deepened and railroads maintained and improved, especially by expanding hauling capacity. Unless transportation is improved, markets will not be assured of continuous and reliable coal supplies.

Other Alternatives

Other federal programs designed to alleviate the impact of rising energy costs on the low income population fail to address the long-term implications of these trends. Although the Low-Income Energy Assistance program attempts to compensate for rising energy costs, relatively little funding is provided for weatherization of low income housing. Until this basic imbalance is addressed, the federal government will face continually rising energy assistance needs while neglecting an opportunity to cut costs both to the federal government and to low income families. In addition, federal investment in weatherization for low income housing would provide employment opportunities for relatively low-skilled workers in locally depressed areas while helping reduce federal deficits in future years.

It also is crucial to maintain adequate funding and personnel for the Energy Information Administration, which is responsible for providing Congress, the federal government, state governments, and the public with independently collected state- and sector-specific supply, consumption, and price information so that the impact of past and present energy policies can be analyzed. The Energy Information Administration should work closely with state and local governments to ensure the reliability and accuracy of federally provided information. It should be required to continue an annual residential energy survey to provide needed information on a changing market. This information is used to determine the need for federal energy assistance and to measure the impact of efficiency investments. Commercial and industrial surveys also are needed to determine the market for and rate of investment in energy efficiency improvements. Without reliable information, decision-makers cannot make good choices or good policy.

VII. CONCLUSION

Dramatic increases in the price of energy affect all consumers, whether rural or urban, farmers or businesses. These increases also have brought to light the bias of past and present federal energy policies. Even though market imperfections retard investment in renewable resources and energy efficiency, federal programs and incentives in this area are being reduced or eliminated, perpetuating current energy biases.

A balanced federal energy policy must be based on a recognition of its impact on all sectors of the economy, not just on domestic producers of energy. Developments in the last few years show that renewable resources and energy efficiency gains represent the most cost-effective and largest potential supply of energy. Even more important, this potential exists closer to the point of consumption, and holds the promise of creating more jobs, both locally and nationally, than the pursuit of capital-intensive strategies.

The alternatives presented here could be implemented at no additional cost to the federal government, but rather could be funded through a reallocation of current expenditures. Given the grave economic implications of continuing our present course, the federal government must balance its energy budget to reflect the potential energy available in every region and from every source.

NOTES

1. A BTU (British thermal unit) is the quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit. Different energy sources have different amounts of heat. For example, one quadrillion BTUs are approximately equal to the following:

   - o 172 million barrels of crude oil
   - o 471 thousand barrels of crude oil per day for 1 year
   - o 8.0 billion gallons of gasoline
   - o 969 billion cubic feet of natural gas
   - o 293 billion kilowatt-hours of electrical consumption
   - o 44.4 million short tons of coal.

   Source: Energy Information Administration, 1981 Annual Report to Congress, Volume 3, Energy Projections (Washington, D.C.: February 1982), p. 138.

2. Figures for 1981 energy consumption, production, and imports taken from Energy Information Administration, Monthly Energy Review (Washington, D.C.: U.S. Department of Energy, May 1982) pp. 2,14.

3. Irving Hoch, "Energy and Location," in Nonmetropolitan America in Transition (Chapel Hill, North Carolina: University of North Carolina Press, 1981), p. 8.

4. Energy Information Administration, State Fuel Price Series (Washington, D.C.: U.S. Department of Energy, March 1982).

5. Energy Information Administration, Nonresidential Buildings Energy Consumption Survey: Fuel Characteristics and Conservation Practices (Washington, D.C.: U.S. Department of Energy, June 1981), p. 5.

6. Diane DeVaul, National and State Energy Expenditures, 1970-1980 (Washington, D.C.: Northeast-Midwest Institute, July 1981).

7. Ibid.

8. Solar Energy Research Institute (SERI), A New Prosperity: Building a Sustainable Energy Future (Andover, Massachusetts: Brick House Publishing, 1981), p. 2. Estimate based on projected savings of 25 percent of total energy consumption by year 2000.

9. Tax incentives refer to special provisions of federal tax law that provide exemptions for special categories of spending. Tax expenditures refer to the loss of budget receipts by fiscal year resulting from each of these particular features of the tax system.

10. Certain capital costs necessary to discover and develop certain mineral properties may be deducted as current expenses rather than amortized over the useful life of the property. Included in this category are the

intangible drilling costs of oil wells, such as the wages of drilling crews, and the cost of developing other mineral deposits, such as expenditures for mine shafts, tunnels, and stripping.

Extractive industries generally use percentage depletion rather than cost depletion. Under cost depletion, actual outlays, to the extent they are not recovered immediately through expensing of exploration and discovery and development costs, may be deducted over the productive life of the property, much as businesses may take deductions for the depreciation of other capital goods. Percentage depletion is not likewise limited to the cost of the investment. Under percentage depletion, taxpayers may deduct a percentage of gross income from mineral production at rates ranging from 22 percent for oil and gas to 5 percent for certain other minerals.

See Office of Management and Budget, Special Analyses: Budget of the United States Government, Fiscal Year 1982 (Washington, D.C.: U.S. Government Printing Office, January 1981), p. 214.

11. Stripper wells are wells that produce less than ten barrels per day on the average. In the U.S., stripper wells comprise about 70 percent of the total number of wells, but account for only 16 percent of domestic oil production.

12. Although this figure has been criticized because it includes deductions from taxable income of such costs as depletion of reserves and exemption of certain types of oil from price controls, justification for including them is strong. As seen from the review of federal energy policy, policymakers included these incentives to protect domestic production and stimulate exploration. They were in fact consciously chosen subsidies to the oil industry and were articulated as such.

13. (Battelle Memorial Institute, An Analysis of the Results of Federal Incentives Used to Stimulate Energy Production (Richland, Washington: June 1980), p. 7.1.

14. Crawford G. Goodwin, editor, Energy Policy in Perspective: Today's Problems, Yesterday's Solutions (Washington, D.C.: The Brookings Institute, 1981), p. 79.

15. Ibid, pp. 230 and 251.

16. Ibid, p. 306.

17. Arthur Anderson and Company, Economic Recovery Tax Act of 1981 (Washington, D.C.: August 1981), pp. 32-33.

18. Diane DeVaul, Regional Energy Economics: The Impact of the Price Increases of the 1970s, (Washington, D.C.: Northeast-Midwest Institute, August 1982), p. 21.

19. Ibid.

20. Battelle, p. 8.1

21. Ibid., p. 8.17.

22. Ibid., p. 6.5.

23. Robert Stobaugh and Daniel Yergin, editors, Energy Future: Report of the Energy Project at the Harvard Business School (New York, New York: Random House, 1979), p. 80.

24. Ibid.

25. Ibid, p. 79.

26. Battelle, pp. 4.1, 21.2.

27. Ibid., p. 4.2.

28. Goodwin, p. 328.

29. Energy Information Administration, Steam-Electric Plant Construction Costs and Annual Production Expenses 1978 (Washington, D.C.: U.S. Department of Energy, December 1980), pp. xiii and xiv.

30. Battelle, p. 5.1.

31. Ibid.

32. Goodwin, p. 168.

33. Battelle, p. 5.5.

34. Energy Information Administration, State Fuel Prices (Washington, D.C.: Department of Energy, March 1982).

35. SERI, p. 356.

36. Ibid., p. 357.

37. Battelle, p. 9.1.

38. Ibid., pp. 9.5-9.6.

39. Ibid., pp. 9.6-9.10.

40. Congressional Research Service, Library of Congress, The Energy Factbook: Data on Energy Resources, Reserves, Production, Consumption, Prices, Processing, and Industry Structure, (prepared for Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, November 1980), p. 651.

41. Goodwin, p. 576.

42. Richard Corrigan, "With an Off-Handed Push from Congress, Speculators Plunge into Small Hydro," National Journal, May 30, 1981, p. 977.

43. Energy Information Administration, Residential Energy Consumption Survey: Building Characteristics, March 1981, Table 1, p. 3.

44. Energy Information Administration, Non-Residential Building Energy Consumption Survey: Building Characteristics, March 1981, Table 5A, p. 19.

45. A variety of tax incentives stimulate energy conservation and encourage conversion to energy sources other than oil or natural gas. Individuals may take a 15 percent income tax credit for home insulation and other energy-conserving components up to a maximum credit of $300. The Crude Oil Windfall Profit Tax of 1980 increased the credit allowed under prior law for expenditures on solar and other renewable energy source property to 40 percent of the first $10,000 of qualifying expenditures.

    In addition to the investment tax credit, prior law allowed a 10 percent credit for business investments in specified energy property. Such property included alternative energy property (i.e., property using fuel other than oil or natural gas); solar or wind energy property; specially defined energy property (i.e., property used in an existing industrial, agricultural, or commercial facility to reduce the amount of energy consumed or heat wasted); recycling equipment; shale oil equipment, and equipment for producing natural gas from geopressurized brine.

    The Crude Oil Windfall Profit Tax Act of 1980 made several modifications to these subsidies. The 10 percent credit for solar, wind or geothermal energy property was increased to 15 percent, and facilities that produce process heat from solar energy in agricultural and industrial applications were made eligible for the credit. A 15 percent credit is now available for ocean thermal equipment installed at two sites to be designated by the secretary of the treasury, and an 11 percent credit is available for certain small-scale hydroelectric generating property. Furthermore, a 10 percent credit for biomass property was extended through 1985. The 1980 act extended the 4 cents per gallon federal excise tax exemption for gasohol from October 1, 1984, through December 31, 1992, and provided a corresponding production income tax credit for alcohol used as a fuel in applications where the excise tax is not assessed. The 1980 act also allowed the financing of certain properties with tax exempt industrial development bonds certain small-scale hydroelectric generating facilities owned by a governmental unit, and facilities that produce steam or alcohol from solid waste.

    See Office of Management and Budget, Special Analyses, pp. 215-216.

46. Energy expenditures for 1980 from Diane DeVaul, National and State Energy Expenditures, 1970-1980 (Washington, D.C.: Northeast-Midwest Institute, July 1981).

47. SERI, p. 8.

48. Marc H. Ross and Robert H. Williams, Our Energy: Regaining Control (New York, N.Y.: McGraw Hill, 1981), pp. 26-30.

49. Ibid, p. 47.

50. Unpublished data provided by Internal Revenue Service, February 1982.

51. James De Metro, Energy Consumption in New York City, Phase I, Patterns and Opportunities (New York, N.Y.: New York City Energy Office, April 1981), p. 12.

52. Ibid., p. 28. New York City depends more on oil as a basic energy source than many other cities — 71 percent compared with a national average of 44 percent in 1979. Although New York City is somewhat atypical because of its higher dependence on petroleum products, it was used as an example in this section because of the amount of data published on both its current consumption and its analysis of potential savings.

53. Ibid., p. 30.

54. Ibid., p. 11.

55. Ibid., p. 13.

56. Ibid., p. 31.

57. U.S. Department of Energy, Interrelationship of Energy and the Economy: A Supplement to the National Energy Policy Plan (Washington, D.C.: July 1981), p. 60.

58. Diane DeVaul, Regional Energy Economics, p. 43.

59. Steven Kaye, editor, Multi-Family Energy Conservation. A Reader (Hartford, Connecticut: Coalition of Northeast Municipalities, July 1981), p. 12.

60. Energy Information Administration, Residential Energy Consumption Survey: Characteristics of the Housing Stock and Households, 1978 (Washington, D.C.: February 1980), p. 10.

61. Energy Consumption in New York City, p. 69.

62. Kaye, p. 10.

63. Ibid., p. 221.

64. Ibid., p. 218.

65. Ibid., p. 11.

66. Ibid., p. 14.

67. Ibid., p. 15.

68. SERI, p. 116.

69. Kaye., p. 156.

70. SERI, p. 11.

71. Ibid., p. 14.

72. Kaye, p. 95-96.

73. National and State Energy Expenditures.

74. Marc H. Ross and Robert H. Williams, Our Energy: Regaining Control: A Strategy for Economic Revival through Redesign in Energy Use (New York, N.Y.: McGraw-Hill Book Company, 1981), p. 194.

75. SERI, p. 165.

76. Ibid., p. 141.

77. Energy Information Administration, Nonresidential Buildings Energy Consumption Survey: Part 2: Fuel Characteristics and Conservation Practices (Washington, D.C.: U.S. Department of Energy, June 1981), p.11.

78. SERI, p. 181.

79. Ibid., p. 34.

80. Ibid.

81. Earl T. Hayes, "Energy Implications of Materials Processing," Science, Volume 191, No. 4228, February 20, 1976.

82. National and State Energy Expenditures.

83. SERI, p. 225.

84. Nonresidential Building Energy Consumption Survey, p. 5.

85. Warren Brown, "Job Layoffs Creating 'New Poor,'" Washington Post, March 28, 1982, pp. B1, 3.

86. Dennis W. Carlton, Why Firms Locate Where They Do, A Planning Working Paper, #57 (Washington, D.C.: Joint Center for Urban Studies, 1981), p. 3-4.

87. Energy Information Administration, Monthly Energy Review, March, 1982, pp. 20-24.

88. Joseph J. Tribble and Donald G. Dodge, "District Heating and Cooling: Current Status and Future Prospects," testimony before the Committee on Science and Technology, U.S. House of Representatives, July 23, 1981, pp. 5, 9.

89. SERI, pp. 240-242.

90. Jon Clark, Building an Energy Consensus: Key Issues for the Eighties (Washington, D.C.: Northeast-Midwest Institute, July 1981), pp. 16, 39.

91. Ibid., p. 16.

92. Ibid., p. 39.

93. The total energy consumption for 1978 is different under the report summarized here than the EIA total consumption for 1978. Some of the difference is attributable to the exclusion by Hoch of coke in the industrial sector. Hoch and EIA also include different categories of fuel products in the commercial and industrial sectors. There also may be other differences. The ratio of energy use between metropolitan and nonmetropolitan areas was used to approximate energy savings potential in 2000.

94. This is a very rough estimate based on a 30 percent reduction in residential and commercial energy use in urban areas by 2,000. The wide range reflects in part the uncertainty of future development patterns. It is impossible to estimate the extent of future migration patterns and areas of commercial development.

95. Energy Resource Advisory Board, Federal Energy R&D Priorities: Report of the Energy Research Advisory Board (Washington, D.C.: U.S. Department of Energy, November 1981).

96. Ibid., p. 21.

97. Ibid., p. 22.

98. Mary Procter, Office of Technology Assessment, testimony before the Subcommittee on Energy Development and Applications, Committee on Science and Technology, U.S. House of Representatives, July 23, 1981.

99. Energy Information Administration, 1981 Annual Report to Congress, Volume 3, Energy Projections (Washington, D.C.: Office of Technology Assessment, February 1982), p. 175.

100. Northeast-Midwest Institute, A Regional Analysis of President Reagan's Fiscal 1983 Budget (Washington, D.C., February 8, 1982), pp. 8-1, 8-6.

101. Dr. Robert H. Williams, letter to U.S. Representative Tom Railsback, July 29, 1981.

102. Kenneth K. Smeltzer, Employment Impacts of Selected Solar and Conventional Energy Systems: A Framework for Comparisons and Preliminary Findings (Argonne, Illinois: Argonne National Laboratory, January 1980), p. 26.

103. Ibid., p. 24.

104. Steven Buchsbaum and James W. Benson, Jobs and Energy, The Employment and Economic Impacts of Nuclear Power, Conservation, and Other Energy Options (New York, N.Y.: Council on Economic Priorities, 1979), p. 63.

105. Ibid., p. 57.

106. Ibid., pp. 59-60.

107. Employment Impacts of Selected Solar and Conventional Energy Systems, p. 21.

108. U.S. Department of Energy, Securing America's Energy Future: The National Energy Policy Plan (Washington, D.C., July 1981), p. 1.

109. Ibid., p. 5.

110. Ibid., pp. 15-16.

BIBLIOGRAPHY

Alliance to Save Energy. "The Administration's Fiscal 83 Energy Policy, An Unbalanced Budget." Washington, D.C., March, 1982.

Arthur Anderson and Company. Economic Recovery Tax Act of 1981. Washington, D.C., August, 1981.

Atomic Industrial Forum. "Nuclear Power Plants in the U.S.." Washington, D.C., December 31, 1981.

Battelle Memorial Institute. An Analysis of the Results of Federal Incentives Used to Stimulate Energy Production. Richland, Washington: Pacific Northwest Laboratory, June 1980.

Bowman, La Barbara. "Provide Heat in Projects, City Is Told." The Washington Post, February 13, 1982.

Brown, Warren. "Job Layoffs Creating 'New Poor'." The Washington Post, March 28, 1982.

Buchsbaum, Steven, and James W. Benson. Jobs and Energy. The Employment and Economic Impacts of Nuclear Power, Conservation, and Other Energy Options. New York, N.Y.: Council on Economic Priorities, 1979.

Carlton, Dennis W. Why Firms Locate Where They Do. A Planning Working Paper, #57. Cambridge, Massachusetts: Harvard-MIT Joint Center for Urban Studies, 1981.

Clark, Jon. Building an Energy Consensus: Key Issues for the Eighties. Washington, D.C.: Northeast-Midwest Institute, 1981.

Congressional Research Service. The Energy Factbook: Data on Energy Resources, Production, Consumption, Prices, Processing and Industry Structures. Prepared at the request of the Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, U. S. House of Representatives. Washington, D.C., November, 1980.

Corrigan, Richard. "With an Off-Handed Push from Congress, Speculators Plunge Into Small Hydro." National Journal, May 30, 1981.

De Metro, James. Energy Consumption in New York City, Phase I, Patterns and Opportunities. New York, N.Y.: New York City Energy Office, April 1981.

De Vaul, Diane. National and State Energy Expenditures, 1970-1980. Washington, D.C.: Northeast-Midwest Institute, July 1981.

De Vaul, Diane. Regional Energy Economics: The Impact of the Price Increases of the 1970s. Washington, D.C.: Northeast-Midwest Institute, April, 1982.

Energy Information Administration. 1981 Annual Report to Congress, Volume 3, Energy Projections. Washington, D.C.: U.S. Department of Energy, February, 1982.

Energy Information Administration. Monthly Energy Review. Washington, D.C.: U.S. Department of Energy, February 1982.

Energy Information Administration. Non-Residential Building Energy Consumption Survey: Part 1: Building Characteristics. Washington, D.C.: U.S. Department of Energy, March 1981.

Energy Information Administration. Non-Residential Building Energy Consumption Survey: Part 2: Fuel Characteristics and Conservation Practices. Washington, D.C.: U.S. Department of Energy, June 1981.

Energy Information Administration. Residential Energy Consumption Survey: Characteristics of the Housing Stock and Households, 1978. Washington, D.C.: U.S. Department of Energy, February 1980.

Energy Information Administration. State Fuel Price Series. Washington, D.C.: U.S. Department of Energy, March 1982.

Energy Information Administration. Steam-Electric Plant Construction Costs and Annual Production Expenses, 1978. Washington, D.C.: U.S. Department of Energy, December 1980.

Goodwin, Crawford G., editor. Energy Policy in Perspective: Today's Problems, Yesterday's Solutions. Washington, D.C.: The Brookings Institute, 1981.

Hayes, Earl T. "Energy Implications of Materials Processing." Science, February 20, 1976.

Hoch, Irving. "Energy and Location." Nonmetropolitan America in Transition. Chapel Hill, North Carolina: University of North Carolina Press, 1981.

Hoch, Irving, Richard T. Carson, Jr., and Charles M. Paulsen. Nonmetropolitan Energy Use: Consumption and Expenditures in 1978, with Comparisons to Metropolitan Energy Use. Washington, D.C.: Resources for the Future, October 1981.

Internal Revenue Service. Statistics of Income Bulletin, Vol. 1, No. 3, Winter 1981-82. Washington, D.C.: Department of the Treasury.

Kaye, Steven, editor. Multi-Family Energy Conservation, A Reader. Hartford, Connecticut: Coalition of Northeast Municipalities, July 1981.

Landsberg, Hans H., and Joseph M. Dukert. High Energy Costs: Uneven, Unfair, Unavoidable. Washington, D.C.: Resources for the Future, 1981.

Northeast-Midwest Institute. A Regional Analysis of President Reagan's Fiscal 1983 Budget. Washington, D.C., February 8, 1982.

Office of Management and Budget. Special Analyses: Budget of the United States Government, Fiscal Year 1982. Washington, D.C., January 1981.

Proctor, Mary. Office of Technology Assessment. Testimony before the Subcommittee on Energy Development and Applications, Committee on Science and Technology, U.S. House of Representatives, Washington, D.C., July 23, 1981.

Ross, Marc H., and Robert H. Williams. Our Energy: Regaining Control: A Strategy for Economic Revival through Redesign in Energy Use. New York, N.Y: McGraw-Hill Book Company, 1981.

Smeltzer, Kenneth A. Employment Impacts of Selected Solar and Conventional Energy Systems: A Framework for Comparisons and Preliminary Findings. Argonne, Illinois: Argonne National Laboratory, January 1980.

Solar Energy Research Institute. A New Prosperity: Building A Sustainable Energy Future. Andover, Massachusetts: Brick House Publishing Company, 1981.

Stobaugh, Robert, and Daniel Yergin, editors. Energy Future: Report of the Energy Project at the Harvard Business School. New York, N.Y.: Random House, 1979.

Tribble, Joseph J., and Donald G. Dodge. "District Heating and Cooling: Current Status and Future Prosperity." Testimony before the Committee on Science and Technology, U.S. House of Representatives, Washington, D.C., July 23, 1981.

U.S. Department of Energy. Interrelationship of Energy and the Economy: A Supplement to the National Energy Policy Plan. Washington, D.C., July 1981.

U.S. Department of Energy. Office of the Budget. "ERDA-DOE Energy R and D." Washington, D.C., February 11, 1982.

U.S. Department of Housing and Urban Development. The President's National Urban Policy Report, 1980. Washington, D.C., August 1980.

U.S. Department of the Treasury. Office of Tax Analysis. "Energy Tax Expenditures." Washington, D.C., December 1980.

U.S. Synthetic Fuels Corporation. "Press Release." Washington, D.C., January 18, 1982.

Williams, Dr. Robert H. Letter to Congressman Tom Railsback. July 29, 1981.

The Northeast-Midwest Institute conducts a Donor Campaign through which private-sector organizations make unencumbered contributions that support the Institute's research program. Current contributors to this campaign include the following organizations:

Burlington Northern, Inc.
Connecticut Education Association
Great Lakes Electric Consumers Association
International Brotherhood of Electrical Workers
Maine Teachers Association
Maryland State Teachers Association
Massachusetts Teachers Association
Michigan Education Association
Minneapolis Central Labor Union Council
Minneapolis Federation of Teachers
Minnesota Federation of Teachers
New Hampshire Education Association
New Jersey Education Association
Ohio Education Association
Pennsylvania State Education Association
Touche Ross, Inc.
TRW, Inc.
United Auto Workers
Wisconsin Education Association Council
Xerox, Inc.

Other reports published recently by the Northeast-Midwest Institute:

REGIONAL ENERGY ECONOMICS
The Impact of the Price Increases of the 1970s
Diane DeVaul $9.00

BALANCE OR BIAS?
Building an Equitable Energy Budget
Diane DeVaul $4.00

RETOOLING THE AMERICAN WORK FORCE
Toward a National Training Strategy
Pat Choate $5.00

REGIONAL PERSPECTIVES ON NEW FEDERALISM
Peter Doyle $5.00

BUILDING A WATER POLICY CONSENSUS
Key Issues for the Eighties
Margaret Downs $6.00

WATER RESOURCE PRIORITIES FOR THE MIDWEST
Revised 1982 Edition
Margaret Downs $5.00

BUILDING AN ENERGY CONSENSUS
Key Issues for the Eighties
Jon Clark $5.00

THE 1982 USERS GUIDE TO GOVERNMENT ENERGY PRORAMS $7.50

SHUTDOWN
A Guide for Communities Facing Plant Closings
Jacqueline Mazza and Virginia Mayer $8.00

THE GUIDE TO THE FEDERAL BUDGET
Fiscal 1983 Edition
Stanley Collender $8.00

THE 1982 USERS GUIDE TO GOVERNMENT RESOURCES FOR ECONOMIC DEVELOPMENT $7.50

DOING BUSINESS WITH THE FEDERAL GOVERNMENT
The 1982 Users Guide $5.00

Please enclose $1.50 for postage and handling with each order. To obtain copies of these publications, or a list of all Institute publications, write:

NORTHEAST-MIDWEST INSTITUTE
Publications Office
P.O. Box 37209
Washington, D.C. 20013